Taylor Wimpey Central London

Mount Pleasant – Phoenix Place Site

Desk Based Review and Supplementary Investigation

Project no. 29518-01 (00)

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RSK GENERAL NOTES

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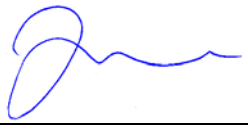
Signature		Signature	
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1 INTRODUCTION

RSK Environment Limited (RSK) was commissioned by AECOM (the 'Engineer'), on behalf of Taylor Wimpey Central London (the 'Client') and Bouygues UK to carry out a review of the available information, and supplementary investigation of the land at Mount Pleasant (Phoenix Place Site), London. It is understood the site is being considered for mixed use redevelopment with the construction of high-rise residential tower blocks and commercial properties.

This report is subject to the RSK service constraints given in **Appendix A**.

1.1 Objective

The objective of the work is to provide information on ground and groundwater conditions beneath the site to assist the geotechnical design of the proposed development, and specifically, the investigation of historical foundation profiles and below ground structures.

1.2 Scope

The project was carried out to an agreed brief as set out in RSK's proposal (ref: BoQ Phoenix Place Site - 29518 02, dated 11th October 2017) and scope of work document provided by Bouygues UK (GSP/MPL/RSK/2202/L/101, dated 18th September 2017), and includes the following:

Desk based review of previous investigation reports (refer to Section 1.3 for available reports), including:

- Geology – shrinkable clay, chalk/swallow holes, running sand, slips, Made Ground, shallow groundwater, shallow mining, and chemical attack on concrete;
- Hydrogeology – the water regime within the strata on and adjacent to the site;
- Hydrology – the water regime on and adjacent to the site;
- Information from the Environment Agency, such as whether the site is on an aquifer, any abstractions of groundwater, discharges, pollution incidents;
- Likely presence of Hazardous substances;
- Anecdotal Evidence;
- Existing structures likely to be present on site; and
- A site walkover.

Intrusive site works comprising:

- The excavation of 10No. trial pits, to a maximum depth of up to 4.4meters below ground level (mbgl) to determine the profile of walls/foundations;
- One day of dynamic sampling, with the installation of 4No. shallow ground gas and groundwater monitoring installations;

- Three days of UXO clearance in medium risk areas identified by the BACTEC UXO desk study report; and
- Asbestos watching brief for the duration of the excavations, and measures to mitigate any potential asbestos fibre release;

Groundwater and ground gas monitoring of existing and recently installed shallow ground gas and groundwater monitoring installations.

1.3 Existing reports

The following reports detailing previous works at the site were made available for review:

- RSK - Phoenix Place Interpretative Geotechnical Report; report ref: 28549-02 (00), dated June 2017;
- Geotechnics Limited: 'Ground Investigation at Mount Pleasant redevelopment, Farringdon Road', report ref: PC051744, dated November 2005;
- RSK – Geophysical Report – Geophysical Report, Mount Pleasant Enabling Works, Site Wide GPR Surveys report ref: 191747 R09 , dated November 2016;
- BACTEC International Limited: 'Explosive Ordnance Treat Assessment in respect of, Mount Pleasant Sorting Office, London', report ref: 4144TA, dated February 2012; and
- Waterman Infrastructure & Environment Limited: 'Preliminary Environmental Risk Assessment – Phoenix Place Site, Mount Pleasant, London, report ref: WIE13235-102-R-2-1-7-BGAH, dated June 2016.

Information from these reports pertinent to this study has been referenced in relevant sections of the report.

1.4 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects.

While asbestos-containing materials were not identified during the fieldworks, the history of the site indicates that asbestos may well be present. Asbestos is often present in discrete areas. Although it may not be not encountered during the site investigation, it may be found during more extensive ground works.

2 THE SITE

2.1 Site location and description

The Phoenix Place Site is located within the London Borough of Camden, at National Grid reference 530945^{E}, 182264^{N}, as shown on **Figure 1**. Calthorpe Street bounds the site to the north, the southern boundary is formed by the Mount Pleasant, while Gough Street and Phoenix Place bounds the site to the west and east, respectfully.

The site covers an area of approximately 1.1 hectares, and comprises open land formerly used as a car-park for the Royal Mail staff, with vehicular access from Phoenix Place (street) from the east. The site slopes down from the north-west to the south-east, with four distinct platforms, at levels of between 19 mAOD to 14 mAOD (**Figure 2)**.

The culverted River Fleet sewer runs north to south, beneath Phoenix Place (street), discharging in the River Thames.

The site surroundings comprise mixed residential/commercial properties, typical for the urban area of central London.

2.2 Proposed development

The project is part of a larger redevelopment masterplan for the former Royal Mail site, which proposes to consolidate Royal Mail's activities, and populate the released site area with new residential and commercial properties.

The proposed development of the subject site is split into two areas known as Plot P1 and Plot P2, comprising four separate buildings (Buildings A, B, C and D).

The southern part of the site (Plot P1) is proposed to be developed with Building A, a 'U' shaped building with a public square in the middle. The building is proposed to be between five and 15-storeys in height, accommodating residential, retail and community uses. A two-storey basement providing Royal Mail staff and residential car parking, storage space and plant rooms is proposed beneath the entire footprint of Plot P1.

The northern part of the site (Plot P2) is proposed to be developed with five to ten storeys high Buildings B, C and D, separated above ground by a communal garden, a courtyard and public open space. The buildings are proposed to accommodate residential, retail and community uses. A separate single storey basement is proposed to be constructed beneath Buildings B and C, and below the courtyard to accommodate car parking, plant rooms, lobby, residential and commercial uses.

Public and private communal amenity space would comprise a combination of hard and soft landscaped areas.

The proposed layout and elevations of the site are shown on **Figure 3** and **Figure 4**.

3 DESK BASED REVIEW

3.1 Site walkover

The site was visited on 16th October 2017 to undertake a site walkover with a representative of 'the Engineer' (AECOM). The principal purpose of the walkover was to identify intrusive locations for the trial pitting. Photographs and the site walkover checklist are provided in **Appendix C.**

No potentially significant ground contamination or geotechnical issues were identified during the site walkover.

A retaining structure is present at the western boundary along Gough Street, its height varying between 1 m and 3 m. The majority of the site is covered by compacted fill material and concrete, which is in poor condition (**Figure 2**).

A possible interceptor or tank is located below ground in the south west corner of the site.

3.2 Ground conditions

3.2.1 Geology

Published records (British Geological Survey) for the area indicate that the superficial geology of the central and southern part of the site is characterised by the presence of alluvial deposits associated with the historical course of the River Fleet. The Hackney Gravel Member of the River Terrace Deposits feathering margin is also shown on the northern site boundary. The underlying solid geology comprises a sequence of the London Clay Formation, which outcrops in the northern portion of the site, the Harwich Formation, the Lambeth Group and the Thanet Sand Formation, with the White Chalk Subgroup at depth. It should be noted that in the London area, the Woolwich Formation typically replaces the Reading Formation in the Lambeth Group. However, in central and south east London, the two formations interdigitate and both are present in the site area.

Information available from the investigation conducted by RSK in 2016 (Ref 28549-02) confirms the succession indentified within published records and the previous Geotechnics Ltd investigation (2005), revealing that the site is underlain by a variable thickness of made ground over the Alluvium and Hackney Gravel Member (River Terrace Deposits). The solid geology was encountered as a succession comprising the London Clay Formation, the Harwich Formation, the Lambeth Group and the Thanet Sand Formation, with the White Chalk Sub-group encountered at depth.

The ground conditions encountered during the 2016 investigation by RSK are summarised in **Table 1**, and the in situ and laboratory test results for each strata are summarised in subsequent subsections with. The exploratory hole locations from the investigation conducted by RSK are indicated in **Figure 5**.

Table 1: General succession of strata encountered in recent RSK investigation (2016)

Strata	Exploratory holes encountered	Depth to top of stratum m bgl (mAOD)	Thickness (m)
Made ground	All	Ground Level (18.72 to 11.89)	3.0 to 8.70 (not proven in WS14; WS17; TP1; TP3 to TP6; TP8 to TP10 and TP18 to TP21)
Alluvium	BH11; BH22, WS16 and TP7	3.10 to 3.90 (13.96 to 7.99)	0.30 to 4.00 (not proven in WS16 and TP7)
Hackney Gravel Member	BH11; BH19 and BH20; WS13 and WS18	3.10 to 7.50 (13.87 to 19.96)	0.40 to 1.00
London Clay Formation	All (except WS14; WS16; WS17; TP1, TP3 to TP10 and TP18 to TP21, and where the superficial deposits were not proven	3.00 to 8.70 (14.63 to 7.35)	3.0 to 10.90 (not proven in all shallow boreholes and trial pits)
Harwich Formation	BH11, BH19, BH21	11.0 to 15.00 (7.72 to 1.92)	1.50 to 1.60
Lambeth Group	All (except all WS BHs; TPs)	9.00 to 19.40 (2.89 to -0.68)	15.90 to 19.50
Thanet Sand Formation	All (except all WS BHs; TPs)	27.50 to 34.00 (-13.30 to -17.08)	5.60 to 10.30 (not proven in BH11; BH12; BH19; BH21 and BH22)
White Chalk Sub-group	BH13; BH14; BH15B; BH20 and BH23	35.60 to 39.30 (-20.91 to -21.69)	proven to a maximum depth of 50.03 mbgl in BH13 (-35.41 mAOD)

*3.2.1.1 **Made Ground***

The made ground was found with a variable thickness ranging from 3.00 m to 8.70 m, comprising a silty or clayey, gravelly sand, with variable proportions of gravel and cobble size brick and concrete fragments, and rare to occasional anthropogenic materials such as glass, slate, ash, clinker, coal and metal fragments.

A summary of the in-situ test results in this stratum obtained during the RSK investigation (Ref 28549-02) is presented in **Table 2.**

Table 2: Summary of in-situ and laboratory test results for made ground

Soil parameters	Range
SPT 'N' values	1 to refusal
SPT 'N60' values	0 to 483 (refusal)
Water soluble sulphate (WSO4) (mg/l)	30 to 1310
pH value	7.7 to 9.6

3.2.1.2 *Alluvium*

The Alluvium was encountered beneath the made ground at four locations only, generally located towards the southern boundary of the site, at a depth of 3.10 mbgl to 3.90 mbgl (9.97 mAOD to 7.99 mAOD). The stratum generally comprised greenish brown/grey silty sandy clay. Also, soils believed to be representative of the alluvial deposits were encountered in the northern part of the site in BH11 at a depth of between 3.50 mbgl and 7.50 mbgl (13.96 mAOD to 9.96 mAOD).

A summary of the in-situ test results in this stratum is presented in **Table 3.**

Table 3: Summary of in-situ and laboratory test results for Alluvium

Soil parameters	Range	
Liquid limit (%)	66	
Plasticity limit (%)	24	
Plasticity index (%)	42	
Plasticity term	High	
Moisture content (%)	25 to 32	
Consistency index	0.91	
Consistency term	Stiff	
Grading (%)	Gravel	52
	Sand	26
	Silt	11
	Clay	11
Bulk density (γ) measured by laboratory testing (Mg/m3)	1.91 to 1.96	
SPT 'N' values	15 to 18	
SPT 'N60' values	14 to 16	
Undrained shear strength measured by quick undrained triaxial test (kN/m2)	37	
Strength term	Low	
Coefficient of volume compressibility (Mv) measured by oedometer test (m2/MN)	0.12 to 0.23	
Coefficient of consolidation (Cv) measured by oedometer test (m2/year)	2.69 to 5.20	

3.2.1.3 *Hackney Gravel Member*

This stratum was encountered directly beneath the made ground at a depth of between 3.1 mbgl to 6.0 mbgl (13.87 mAOD to 11.17 mAOD) and 7.50 mbgl in BH11 (9.96 mAOD), and ranged in thickness between 0.40 m to 1.00 m. Based on the site descriptions and laboratory and in-situ tests carried out this layer can be described as a medium dense predominately granular soil of orange brown, silty, sandy, fine to coarse gravel of flint, locally clayey or silty.

A summary of the in-situ test results in this stratum is presented in **Table 4.**

Table 4: Summary of in-situ and laboratory test results for Hackney Gravel

Soil parameters	Range	
Grading (%)	Gravel	46 to 81
	Sand	13 to 32
	Silt / Clay	6 to 22
SPT 'N' values	13	
SPT 'N60' values	12	

3.2.1.4 London Clay Formation

The London Clay Formation was encountered across the entire site, at depths of between 3.00 mbgl and 8.70 mbgl (14.63 mAOD to 7.35 mAOD). Based on the descriptions and in-situ and laboratory testing carried out, this stratum can be described as initially firm to stiff, medium to high strength, brown, weathered, silty, locally, slightly sandy, slightly gravelly clay, becoming stiff to very stiff, high to very high strength, fissured, brown, grey silty clay with occasional selenite crystals.

A summary of the in-situ test results in this stratum is presented in **Table 5.**

Table 5: Summary of in-situ and laboratory test results for London Clay Formation

Soil parameters	Range
Liquid limit (%)	56 to 82
Plasticity limit (%)	18 to 28
Plasticity index (%)	35 to 54
Plasticity term	High to Very High
Moisture content (%)	16 to 43
Consistency index	0.55 to 1.11
Consistency term	Firm to Very Stiff
Bulk density (γ) measured by laboratory testing (Mg/m3)	1.88 to 2.11
SPT 'N' values	9 to 45
SPT 'N60' values	11 to 54
Undrained shear strength measured by quick undrained triaxial test (kN/m2)	42 to 157
Strength term	Medium to Very High (generally High)
Effective cohesion (c') measured by consolidated undrained triaxial test (kN/m2)	18
Angle of shear resistance (φ') measured by consolidated undrained triaxial test (º)	23.8
Water soluble sulphate (WSO4) (mg/l)	160 to 1910
pH value	6.8 to 8.1

3.2.1.5 *Harwich Formation*

The Harwich Formation was encountered only in BH11, BH19 and BH21, as a discreet unit beneath the London Clay Formation, at depths of between 11.00 mbgl to 15.00 mbgl (7.72 mAOD to -1.92 mAOD) and its thickness was proven to be between 1.50 m to 1.60 m. The stratum was highly variable and was recovered as medium dense, grey fine sand, sandy fine to medium gravel of flint, silty, sandy gravel with black pebbles, and shelly mudstone and gravel and cobbles of mudstone.

A summary of the in-situ test results in this stratum is presented in **Table 6.**

Table 6: Summary of in-situ and laboratory test results for Harwich Formation

Soil parameters	Range	
Grading (%)	Gravel	84
	Sand	11
	Silt	4
	Clay	1
SPT 'N' values	17 to 20 (refusal in mudstone)	
SPT 'N60' values	15 to 19 (>500 - refusal in mudstone)	

3.2.1.6 *Lambeth Group*

Beneath the London Clay Formation, soils representative of the Lambeth Group were encountered at depths of 9.00 mbgl to 19.40 mbgl (2.89 mOAD to -0.68 mAOD). The Lambeth Group was encountered with distinct cohesive and granular portions.

The cohesive portion of the stratum formed the majority of the stratum, and was found to directly underlie the London Clay Formation, comprising stiff to very stiff, generally high to very high and locally low and extremely high strength, multicoloured, silty, locally slightly sandy clay.

The predominantly granular soils were encountered in BH13, BH14, BH22 and BH23 mostly towards the base of the stratum, and generally consist of very dense, green, clayey, sandy, rounded fine to coarse gravel of pebbles.

Horizons of predominately clean quartz sand were encountered within in BH11, BH13, BH15B, BH22, BH23 at depths ranging between 16.1 mbgl to 25.0 mbgl and a thickness ranging between 0.5 m to 2.4 m (medium to very thick beds).

A summary of the in-situ test results in this stratum is presented in **Table 7** and, **Table 8**.

Table 7: **Summary of in-situ and laboratory test results for cohesive Lambeth Group**

Soil parameters	Range
Liquid limit (%)	30 to 84
Plasticity limit (%)	16 to 31
Plasticity index (%)	13 to 55
Plasticity term	Intermediate to Very High (locally Low)

Soil parameters	Range	
Moisture content (%)	13 to 39	
Consistency index	0.77 to 1.14	
Consistency term	Stiff to Very Stiff	
Grading (%)[1)]	Gravel	0 to 28
	Sand	40 to 54
	Silt	9 to 27
	Clay	13 to 28
Bulk density (γ) measured by laboratory testing (Mg/m3)	1.95 to 2.19	
SPT 'N' values	16 to refusal	
SPT 'N60' values	15 to 360 (refusal)	
Undrained shear strength measured by quick undrained triaxial test (kN/m2)	21[2)] to 385	
Undrained shear strength measured by shear vane test (kN/m2)	53	
Strength term	generally High to Very High (locally Low and Extremely High)	
Coefficient of volume compressibility (Mv) measured by oedometer test (m2/MN)	0.043 to 0.071	
Coefficient of consolidation (Cv) measured by oedometer test (m2/year)	0.69 to 1.69	
Effective cohesion (c') measured by consolidated undrained triaxial test (kN/m2)	19 to 29	
Angle of shear resistance (φ') measured by consolidated undrained triaxial test (º)	13.1 to 17.6[3)]	
Water soluble sulphate (WSO4) (mg/l)	<10 to 1220	
pH value	7.4 to 9.3	

1) predominantly sandy horizons within the stratum

2) uncharacteristically low values of shear strength

3) uncharacteristically low values of effective friction angle

Table 8: Summary of in-situ and laboratory test results for granular Lambeth Group

Soil parameters	Range	
Grading (%)	Gravel	0 to 93
	Sand	5 to 85
	Silt/Clay	1 to 75
SPT 'N' values	18 to refusal	
SPT 'N60' values	17 to 240 (refusal)	
Density term	Very Dense (locally Medium Dense)	
Water soluble sulphate (WSO4) (mg/l)	40	
pH value	9.1 to 9.4	

3.2.1.7 *Thanet Sand Formation*

The Thanet Sand Formation was encountered in all deep boreholes, beneath the Lambeth Group, at depths of between 27.50 mbgl to 34.00 mbgl (-13.30 mAOD to -17.08 mAOD) and its thickness was proven to be between 5.60 m to 10.30 m. Based on the in-situ and laboratory testing carried out the stratum can be described as very dense, green, grey, silty clayey, fine to medium sand, locally grading into sandy silt.

A summary of the in-situ test results in this stratum is presented in **Table 9.**

Table 9: Summary of in-situ and laboratory test results for Thanet Sand Formation

Soil parameters	Range	
Moisture content (%)	12 to 27	
Grading (%)	Gravel	0 to 8
	Sand	51 to 90
	Silt / Clay	9 to 49
Bulk density (γ) measured by laboratory testing (Mg/m3)	1.84 to 2.09	
SPT 'N' values	Refusal	
SPT 'N60' values	116 to > 500 (refusal)	
Density term	Very Dense	
Effective cohesion (c') measured by consolidated drained shear box test (kN/m2)	0 to 64[1)]	
Effective friction angle (φ') measured by consolidated drained shear box test (º)	2.5[2)] to 35.5	
Water soluble sulphate (WSO4) (mg/l)	50 to 820	
pH value	7.0 to 8.7	

1) uncharacteristically high value of effective cohesion

2) uncharacteristically low value of effective friction angle

3.2.1.8 *White Chalk Sub-group*

The White Chalk was encountered only in boreholes BH13, BH14, BH15B, BH20 and BH23, at depths of between 35.60 mbgl to 39.30 mbgl (-20.91 mAOD to -21.69 mAOD) and was proven to 50.03 mbgl (-35.41 mAOD). As a result of the percussive drilling technique adopted, the stratum was recovered as a structureless melange of sandy silty gravel of chalk with frequent flints.

A summary of the in-situ test results in this stratum is presented in

Table 10.

Table 10: Summary of in-situ and laboratory test results for White Chalk Sub-group

Soil parameters	Range
Liquid limit (%)	23 to 25
Plasticity limit (%)	15 to 19
Plasticity index (%)	8 to 13
Plasticity term	Low
Moisture content (%)	11 to 25

Soil parameters	Range
SPT 'N' values	64 to refusal
SPT 'N60' values	58 to >500 (refusal)
Water soluble sulphate (WSO4) (mg/l)	590
pH value	8.2

3.2.2 Ground Stability

The ground stability risks associated with the Phoenix place site, as reported in the Envirocheck report contained within the 'Preliminary Environmental Risk Assessment – Calthorpe Street Site, Mount Pleasant, London, report ref: WIB13235-102-R-1-1-10-BGAH, dated June 2016 , include the following risk classification as presented in **Table 11**.

Table 11: Summary of in-situ Summary of Ground Stability Risk and Risk Classification

Ground Stability Risk	Risk Classification
Collapsible Ground	Very Low
Compressible Ground	Moderate
Ground dissolution	No Hazard
Landslide	Very Low
Running Sand	Very Low
Shrinking or Swelling Clay	No Hazard

3.2.3 Chemical attack on buried concrete

This assessment of the potential for chemical attack on buried concrete was undertaken in the investigation conducted by RSK in 2016 (Ref 28549-02), and is based on current BRE guidance. Based on testing results, **Table 12** gives the characteristic water-soluble sulphate content values for each of the geological units encountered on site, and the the recommended Design Sulphate Class and Aggressive Chemical Environment for Concrete Class (ACEC-AC) are summarized in **Table 13**

Table 12: Characteristic WSO_4 values for soils beneath the site

Soil type	Water Soluble Sulphate (mg/l)	Characteristic Value of Water Soluble Sulphate (mg/l)
Made Ground	30 to 1310	1175
London Clay Formation	160 to 1910	1710
Lambeth Group	<10 to 1220	835
Thanet Sand Formation	50 to 820	535
White Chalk Sub-group	590	590

Table 13: DS and ACEC-AC Classification

Soil type	Design Sulphate Class	Aggressive Chemical Environment for Concrete Class

Soil type	Design Sulphate Class	Aggressive Chemical Environment for Concrete Class
Made Ground	DS-2	AC-2
London Clay Formation	DS-3	AC-3
Lambeth Group	DS-2	AC-2
Thanet Sand Formation		
White Chalk Sub-group		

However, it is considered that if the proposals include the reuse of the pyritic London Clay Formation, the recommended ACEC Classification will increase to AC-4 with a Design Sulphate Class for the site of DS-4.

3.3 Existing Structures likely to be present on site

3.3.1 RSK non-intrusive geophysical survey

In 2016 RSK Geophysics carried out a non-intrusive geophysical investigation at the Phoenix Place site to seek to determine the presence of buried services and obstructions (report ref: 191747 R09).

The survey techniques employed were that of Ground Penetrating Radar (GPR) utilising a 400MHz antenna to determine features in the ground up to 2.5m depth, an electrolocation (EML) survey with cover lifting exercise, and a Time Domain Electromagnetic (TDEM) survey utilising a Geonics EM61 instrument to determine the presence of buried metallic objects up to 2-3m depth.

The objective of works was to utilise non intrusive techniques to identify and map subsurface features, such as buried utilities and obstructions, that may impact on the redevelopment of the site.

The GPR data detected a number of anomalies across the site ranging from disturbed ground and possible buried foundations to buried services. Two possible buried underground storage tanks were also detected in the GPR survey.

Five categories of distinct anomalies were identified within the electromagnetic (EM) data (**Figure 6a and Figure 6b**), and these have been classified as follows:

Anomaly Type A - Extensive response indicative of reinforced slab

Anomaly Type B - High conductivity anomalies indicative of buried metal

Anomaly Type C - Regular spaced features indicative of possible foundations

Anomaly Type D - Buried linear features indicative of possible services/structures

Anomaly Type E - Surface metal

The integrated results of the EM and PAS 128 GPR utility survey are presented in **Figure 7**.

Further details concerning the non-intrusive geophysical investigation conducted by RSK Geophysics are contained within the RSK Geophysical Report, Mount Pleasant Enabling Works, Site Wide GPR Surveys; report ref 191747_R09; dated November 2016.

3.3.2 Sub-surface obstructions found during previous RSK intrusive works

During the intrusive works conducted by RSK in 2016 (Ref 28549-02), a limited number of exploratory holes encountered concrete obstructions beyond the depth of hand excavation, likely to be associated with previous developments at the site.

A number of obstructions were encountered within the made ground generally in form of historical concrete slabs or foundations, as located at BH15A, BH15B and BH19.

The cable percussion borehole BH15 was relocated twice to avoid a concrete obstruction encountered at 2.5 mbgl and further breaking out of deeper obstructions was required to advance the drilling at the location BH19.

It is considered likely that the foundations of the buildings previously occupying the site such as the foundry, industrial buildings and garages may not have not been removed prior to the construction of the current structures, and may still be encountered during future intrusive works.

3.4 Hydrogeology

3.4.1 Aquifer characteristics

Based on the published geological information and Waterman's Preliminary Environmental Risk Assessment, (report ref: WIB13235-102-R-1-1-10-BGAH, dated June 2016), the hydrogeology of the site is likely to be characterised by the presence of an unconfined shallow Secondary A Aquifer comprising the Alluvium and the Hackney Gravel Member, overlying the London Clay Formation, which is classified as an Unproductive Strata.

Confined by the London Clay Formation, are deep Secondary A Aquifers comprising the Harwich Formation, Lambeth Group and the Thanet Sand Formation, with the White Chalk Sub-group (Principal Aquifer), at depth. These units are expected to be in hydraulic continuity.

The shallow groundwater table is expected to be towards the base of the Hackney Gravel.

It is also possible that localised perched water may also be present in the made ground.

3.4.2 Risk from rising groundwater levels

Rising groundwater levels can result in flooding if not properly controlled. In certain areas groundwater levels are rising owing to reduced groundwater abstraction by industry, with London being at particular risk. The rise in groundwater levels started during the mid-1960s as a result of a significant reduction in groundwater abstraction from the Chalk aquifer. Prior to this, the Chalk aquifer had been increasingly exploited as a result of increasing industrialisation throughout the 19th century and early part of the 20th century.

As defined within CIRIA Special Publication 69 (Simpson et al., 1989), the site lies within the 'Critical Area' of the London Basin in which deep structures are potentially at risk from the rising groundwater levels in the deep aquifer. Deep structures include

basements deeper than about 20 m and other structures whose foundations extend to between 30m and 50m below ground level.

The Environment Agency (EA) status report issued in 2016 'Management of the London Basin Chalk Aquifer' indicates that the piezometric surface of the groundwater in the deep aquifer in the site area in January 2016 was at approximately -35 mAOD, i.e. approximately between 49 m and 54 m below existing ground levels.

3.4.3 Licensed groundwater abstraction

Based on the published geological information and Waterman's Preliminary Environmental Risk Assessment, referred to above, there are no groundwater abstractions identified within a 250m radius of the site.

In terms of aquifer protection, the EA generally adopts a three-fold classification of source protection zones (SPZ) for public supply abstraction wells.

- zone 1 or 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- zone 2 or 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants.
- zone 3 or 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Information available on the EA website indicates that the site does not lie within a currently designated groundwater Source Protection Zone.

3.5 Hydrology

3.5.1 Surface water features

There are no ponds, streams or drainage ditches on or adjacent to the site. The nearest identified surface feature to the site is the Regents Canal, located approximately 1.1 km to the north of the site. The River Thames is some 1.6 km to the south.

Reference to '*The Lost Rivers of London'* (Barton, 1992) and '*London's Lost Rivers'* (Talling, 2011), indicates that the River Fleet historically flowed southwards (just to the east of the site). The current information confirms that this watercourse has been culverted in a sewer flowing beneath Phoenix Place, however, the alluvial tract of the original watercourse is expected to extend beneath the footprint of the site.

3.5.2 Preliminary flood risk assessment

The indicative floodplain map for the area, published by the EA, shows that the site does not lie within the designated floodplain of the River Thames.

This report is not intended to replace a full hydrological study and it is recommended that additional specialist studies be conducted to confirm flood risks at the site.

3.6 Site history

Records show that parts of the site have had a rich history of industrial use, with numerous garages, a print works, a food factory, a foundry and residential properties facing Phoenix Place (Street). The Phoenix Place Site was cleared of buildings during the mid-1970 and Mail Rail House (Petrone House) was demolished in 2014/2015. A number of sunken petrol tanks have also been identified on the site by GOAD fire insurance plans dating from 1927 to 1967.

Further details of historical development of the site are contained within Waterman's Preliminary Environmental Risk Assessment, referred to above.

3.7 Potential contaminants of concern

Contaminants of concern associated with the sites' former uses include heavy metals, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs) volatile organic compounds (VOCs), semi-volatile organic compounds (VOCs), phenols, chlorinated solvents, and asbestos.

The Geotechnics Investigation conducted in 2005 (report ref: PC051744) identified exceedences in concentrations of lead, mercury, benzo(a)pyrene, dibenzo(a,h)anthracene and benzo(b)flouranthene in respect of a conservative residential use without plant uptake end use scenario.

Details of potential sources of contamination from historical uses of the site with risk assessment and recommendations for further work are contained within Waterman's Preliminary Environmental Risk Assessment, referred to above.

A detailed environmental assessment of the Phoenix Place site has thought to have been conducted by Waterman Infrastructure & Environment Limited in 2016/17. The results of which were not made available for comment in this report.

3.7.1 Asbestos Containing Material (ACMs)

In the recent investigation performed by RSK in 2016 (Ref 28549-02), possible Asbestos Containing Material (ACM) was encountered within the made ground from WS16 in the form of a small fragment of cement bound sheeting (confirmed by client's asbestos consultants White Young Green to be probable ACM).

Isolated small fragments of cement bound asbestos (presumed to be chrysotile cement bound asbestos) were also identified by the supervising RSK field engineer to be locally present near surface in the former car park areas in the Phoenix Place site.

3.8 Unexploded ordnance

A brief summary of the BACTEC International Limited: 'Explosive Ordnance Treat Assessment in respect of, Mount Pleasant Sorting Office, London', report ref: 4144TA, dated January 2012 is given below.

The site is located in an area, which was the most heavily bombed area in Britain. ARP bomb census maps and anecdotal accounts indicate that two HE bombs fell immediately adjacent to the southern site (as well as two 1 kg incendiary bomb showers) during 1940/41, and a 500 kg HE bomb fell at the southern corner of the southern site during 1944.

It is considered unlikely that there has been any significant post-war intrusive work on site, therefore the risk of encountering deep buried HE UXBs will not have been mitigated to any serious degree.

There is no evidence to suggest that the site formerly had any British military usage.

Based on the findings, the report concludes that there are areas of Low and Medium risk from unexploded ordnance at the site of the proposed development, and recommended an Explosive Ordnance Disposal (EOD) Engineer presence on site to support shallow intrusive works and carry out intrusive magnetometer survey of all borehole and pile locations down to a maximum bomb penetration depth.

3.9 Licences and permissions

Based on Waterman's Preliminary Environmental Risk Assessment, referred to above, there are no discharge consents within 500m of the site, and there have not been any pollution incidents within 500m of the site. There have also not been any recorded pollution incidents within close proximity to the site.

4 SITE INVESTIGATION METHODOLOGY

RSK carried out intrusive investigation works between 23rd October and 1st November 2017, to determine the profile of walls/foundations and establish the presence of buried obstructions and foundations.

4.1.1 Health, safety and environment considerations

Prior to the commencement of the works, a Construction Phase Plan (CPP) was prepared by RSK. The plan adopted the requirements set out in Health & Safety Executives (2000) "HSG47 Avoiding Danger from Underground Services". The plan included the method statements, risk assessments, COSHH forms and relevant drawings (proposed location plan overlaid with the location of existing underground services).

As a part of a separate contract, RSK Geophysics has carried out a non-intrusive utility detection survey using Ground Penetrating Radar (GPR) and electromagnetic (EML) techniques. The results of this survey were used to inform the location of intrusive positions.

RSK's site manager was responsible for overseeing and supervising the works to ensure that all conditions of the CPP including RSK's 'Permit to Dig' procedure were approved and adhered to.

The scope of works was undertaken in line with RSK's Safety, Health, Environment and Quality Management Systems (SHEQMS), which is accredited to ISO9001: 2008 (Quality Management System standard), ISO14001:2004 (Environmental Management System standard) and OHSAS18001:2007 (Occupational Health and Safety Management System standard).

4.1.2 Investigation locations

The locations of the investigation points were determined by 'the Engineer' (AECOM) to obtain structural and obstruction information at designated locations within the site. These locations were marked on the ground with RSK during the site walkover conducted on 16th October 2017.

The techniques adopted for the investigation were chosen considering the anticipated ground conditions, existing land use, access constraints and the proposed development.

The location and construction detail of shallow ground gas and groundwater monitoring well installations was determined by the Engineer during the investigation works.

The investigation has been carried out in accordance with the requirements provided within the SI specification (provided by Bouygues UK) and agreed with 'the Engineer'.

The locations of the intrusive investigation are shown in **Figure 8**, and the rationale for these locations is given in **Table 14**.

Table 14: Exploratory hole and monitoring well location rationale

Investigation Type	Exploratory hole number	Rationale
Machine excavated trial pits	TP101	To target foundation profile of the wall on western site boundary adjacent to Gough Street and obstructions identified in BH15 and BH15a.
	TP102	To target foundation profile of the wall on western site boundary adjacent to Gough Street.
	TP103	To target potential for underground foundations or structures in south western corner of the site. TP located to south of western boundary wall.
	TP104	To target potential for underground foundations or structures in south western corner of the site.
	TP105	To investigate foundation profile on the western boundary of the site adjacent to Gough Street in the vicinity of BH15b.
	TP106	To target potential for underground foundations or structures in the centre of the site positioned between TP105 and TP107.
	TP107	To target foundation profile of the wall on eastern site boundary next to Phoenix Place.
	TP108	To target foundation profile of the wall on eastern site boundary next to Phoenix Place.
	TP109	To target potential for underground foundations or structures in south eastern corner of the site.
	TP110	To target foundation profile of the wall on western site boundary adjacent to Gough Street north of TP102.
Monitoring well installations	WS19	To enable installation of shallow ground-gas and groundwater monitoring wells.
	WS20	
	WS21	
	WS22	

The ground investigation has been carried out using intrusive ground investigation techniques in general accordance with the recommendations of BS5930: 2015 Code of practice for ground investigations, which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. The exploratory holes were logged by an engineer in general accordance with the recommendations of BS 5930:2015 (which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1). Whilst every attempt is made to record full details of the strata encountered in the exploratory holes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

Detailed descriptions, together with relevant comments, are given in the logs included in **Appendix B**. The 'as built' coordinates and ground levels at each location are included on the exploratory hole records.

4.1.3 Groundwater monitoring and levelling

Depths to groundwater were recorded by RSK using an electronic dip meter on 31st October 2017.

It is noted that further groundwater monitoring is to be carried out with a total of eleven further visits planned before March 2018 as outlined in the scope of work document (provided by Bouygues UK).

The groundwater monitoring results are discussed in **Section 5.2** and include historical monitoring rounds taken by Waterman Infrastructure and Environment Ltd that were reported by RSK in 2016 (Ref 28549-02).

4.1.4 Ground gas monitoring

A ground gas monitoring round was also conducted by RSK on 31st October 2017. An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

The atmospheric pressure before and during monitoring, together with the weather conditions, was recorded.

It is note that further groundgas monitoring as outlined in the scope of work document (provided by Bouygues UK) is to be carried out with a total of eleven further visits planned before March 2018.

The ground gas monitoring results are discussed in **Section 5.2**.

5 GROUND CONDITIONS

The results of the intrusive investigation are detailed below. The descriptions of the material encountered, foundation profiles and any obstructions encountered at each intrusive location ar provided, in addition to a description of material encountered in the dynamic sampling holes WS19 to WS22.

Field observations of soil and groundwater and details of monitoring well installations as well as plans and sections with photographs of exposed buried structures are included on the exploratory hole records, in **Appendix B.**

The intrusive locations are indicated in the exploratory hole location plan in **Figure 8**.

5.1 Soil

The exploratory holes revealed that the site is underlain by a significant thickness of made ground with Hackney Gravel Member (River Terrace Deposits) identified in one location and solid geology comprising the London Clay Formation identified in a further three locations. This confirms the stratigraphical succession described within the previous sections. For the purpose of discussion, the ground conditions are summarised in **Table 15**.

Table 15: General succession of strata encountered

Strata	Exploratory holes encountered	Depth to top of stratum m bgl	Thickness (m)
Made ground	All (TP101 to TP110 & WS19 to WS22)	Encountered at surface	3m to >5m
Hackney Gravel Member	WS19	3.5m	1m
London Clay	TP102 & TP110	3.0m to 4.5m	Unproven

5.1.1 Made ground

The majority of the site is covered by compacted fill material and concrete, which is in poor condition, and bituminous hardstanding in the north of the site (known as the Calthorpe car park).

Where encountered, the concrete slab or bituminous hardstanding was generally 0.20 m or less in thickness. Beneath this (or encountered at surface), the made ground was found with a variable thickness ranging from 3.0m to >5.0 m, comprising a silty or clayey, sand and gravel, with variable proportions of gravel and cobble size brick and concrete fragments or a sandy gravel with cobbles and whole bricks.

Beneath the granular portion of made ground the material became more cohesive and in some locations resembled re-worked natural material (Alluvium and London Clay).

It is very likely that the made ground is site derived demolition rubble from former structures historically present at the site and from re-worked natural material such as Alluvium, Hackney Gravel Member and London Clay Formation, used as a fill during different phases of development at the site.

5.2 Buried obstructions

5.2.1 TP101

TP101 targeted the wall on the south western site boundary with Gough Street. The yellow brick wall bounding the site extended to 2.3mbgl. A weak concrete layer was encountered between 2.3m to 2.4mbgl which was underlain by footings for the yellow wall that extended to 2.8mbgl and 400mm into the site from the base of the wall. These were constructed from red brick. A secondary wall perpendicular to the yellow brick wall was revealed along the south eastern boundary of the trial pit (i.e. parallel with Mount Pleasant Road) which was constructed in brick and had a similar footing profile.

Particularly poor ground conditions were encountered in this location with numerous concrete boulders recovered in the made ground (up to 800mm x 800mm x 400mm). Made ground comprising re-worked natural material however was encountered at the base of the trial pit between 2.8m and 3.3mbgl.

5.2.2 TP102

TP102 was excavated to the north of TP101 in an elevated area (relative to TP101) and targeted the south western site boundary with Gough Street. A red brick wall was identified beneath the site boundary and was found to extend to 1.7mbgl. There were no foundations encountered beneath the wall extending into the site and the trial pit was extended within natural material to 4.0mbgl.

5.2.3 TP103

TP103 was excavated in the southern corner of the site and targeted potential structures in this area, immediately south of the site boundary wall adjoining Gough Street. The trial pit did not reveal any underground structures and made ground material was encountered to 3.3mbgl.

5.2.4 TP104

TP104 was also excavated in the southern corner of the site and targeted potential structures in this area. A brick wall was encountered along the south western boundary of the trial pit with a secondary wall comprising bricks perpendicular to this to the north of the trial pit that was removed during excavation. A small diameter metal pipe was uncovered on the north eastern wall of the pit at 0.5mbgl. No significant foundations were encountered beneath these structures and the trail pit was extended to 3.7mbgl.

5.2.5 TP105

TP105 targeted the south western site boundary with Gough Street above a concrete slab structure (possibly former building structure or level) with known void below. The

excavator broke through the concrete slab at surface to reveal the extent of the void and building structure below. The yellow brick wall bounding the site extended for a further 2.3mbgl and a basement or room was revealed below. The trial pit was abandoned and covered with boards as it was unsafe to progress it any further.

5.2.6 TP106

TP106 targeted the centre of the site between TP102 and TP107. The trial pit did not reveal any underground structures and made ground material was encountered to 3.7mbgl.

5.2.7 TP107

TP107 targeted the wall on the north eastern site boundary with Phoenix Place (to the north of the main entrance currently used to access site). The foundations of the brick wall bounding the site were found to extend to 2.9mbgl and 1.5m into the site from the side of the wall. The footings were constructed of brick and stepped into the site at 1.1m and 2.3mbgl. The trial pit was extended to 4.4mbgl into made ground comprising re-worked natural material.

5.2.8 TP108

TP108 targeted the wall on the north eastern site boundary with Phoenix Place (to the south of the main entrance currently used to access site). The brick wall bounding the site extended to 3.1mbgl with no apparent foundations extending into the site from the side of the wall. During the excavation possible former concrete floor slabs were encountered at 2.7mbgl (easily removed). A secondary brick wall, part of a building structure was revealed perpendicular to the site boundary wall that was encountered to a similar depth. The trial pit was excavated into softer material between 3.4m and 3.9m bgl.

5.2.9 TP109

TP109 targeted the general area in the south eastern part of the site. The trial pit revealed further red brick structures that were encountered on the south western wall of the trial pit. Possible former concrete floor slabs were also encountered at 2.5mbgl (easily removed). The trial pit was excavated into softer material between 2.7m and 3.5m bgl.

5.2.10 TP110

TP110 targeted the wall on the south western site boundary with Gough Street to the north of TP102. The trial pit revealed shallow boundary wall foundations extending beneath the current site boundary to 0.5mbgl and a sub-surface wall also extending to 0.5m bgl running perpendicular to the site boundary. The trial pit was extended into natural material between 3.0m and 3.5mbgl.

5.3 Groundwater regime

Groundwater encountered during the previous investigation and current monitoring period conducted on 31st October in all boreholes is detailed in **Table 16** and **Table 17.**

In addition, a small rate of groundwater seepage was observed in trial pit TP101 reflecting the potential presence of localised perched groundwater in this location above the cohesive made ground.

Table 16: Groundwater monitoring results

BH	Strata	Strike or seepage (mbgl) (mAOD)	Monitoring Results (mbgl) (mAOD)				
			Levels provided by Waterman				
			R1	R2	R3	R4	R5
BH11	AL/HG	ND	5.84 (11.62)	5.60 (11.86)	5.59 (11.87)	5.57 (11.89)	5.77 (11.69)
	HF	15.00 (2.46) & 16.50 (1.16)	10.40 (7.06)	10.42 (7.04)	10.41 (7.05)	10.45 (7.01)	10.40 (7.06)
BH12	MG	ND	4.77 (11.28)	4.82 (11.23)	4.75 (11.30)	4.67 (11.38)	4.67 (11.38)
	LG		17.12 (-1.21)	17.14 (-1.09)	17.97 (-1.92)	17.85 (-1.80)	17.97 (-1.92)
BH13	MG	ND	1.95 (12.74)	1.96 (12.73)	1.96 (12.73)	1.97 (12.72)	1.96 (12.73)
	MG/LCF	7.50 (7.19)	4.20 (10.49)	4.19 (10.50)	4.20 (10.49)	4.15 (10.54)	4.20 (10.49)
BH14	MG	ND	4.66 (9.54)	4.00 (10.20)	3.95 (10.25)	3.96 (10.24)	3.95 (10.25)
	LG	26.50 (-12.30)	26.73 (-12.53)	26.32 (-12.12)	26.45 (-12.25)	26.82 (-12.62)	26.75 (-12.55)
BH15B	MG	ND	Dry				
	LG	18.00 (-0.39)	15.70 (1.91)	14.03 (3.58)	14.22 (3.39)	14.71 (2.90)	14.71 (2.90)
		22.50 (-4.89)	Dry			23.29 (-5.68)	
BH19	MG/HG	ND	3.85 (14.87)	3.90 (14.82)	3.86 (14.86)	3.95 (14.77)	3.73 (14.99)
	LCF/HF/LG	11.00 (7.72)	8.12 (10.60)	8.10 (10.62)	7.50 (11.22)	7.76 (10.96)	7.81 (10.91)
	LG	27.50 (-8.78)	21.69 (-2.57)	21.50 (-2.78)	21.58 (-2.86)	21.55 (-2.83)	21.47 (-2.75)
BH20	MG/AL/LCF	ND	5.37 (11.80)	5.42 (11.75)	5.50 (11.67)	5.59 (11.58)	5.69 (11.48)
	TSF		Not monitored				
BH21	MG/LCF	ND	4.30 (12.62)	3.01 (13.91)	2.99 (13.93)	3.01 (13.91)	2.75 (14.17)

BH	Strata	Strike or seepage (mbgl) (mAOD)	Monitoring Results (mbgl) (mAOD)				
			Levels provided by Waterman				
			R1	R2	R3	R4	R5
	LCF/HF/LG	15.00 (1.92)	9.85 (7.07)	9.83 (7.09)	9.83 (7.09)	9.83 (7.09)	9.80 (7.12)
BH22	MG/AL	3.70 (8.19)	1.97 (9.92)	2.07 (9.82)	1.99 (9.90)	1.99 (9.90)	2.00 (9.89)
BH23	MG/LCF	ND	3.53 (10.48)	3.57 (10.44)	3.60 (10.41)	3.51 (10.50)	3.63 (10.38)
	LG (piezo tip)		24.30 (-10.29)	24.25 (-10.24)	24.20 (-10.19)	24.35 (-10.34)	24.30 (-10.29)

Table 17: Groundwater monitoring results (cont.)

BH	Strata	Strike or seepage (mbgl) (mAOD)	Monitoring Results (mbgl) (mAOD)				
			Levels provided by Waterman				
			R6	R7	R8	R9	31st October 2017
BH11	AL/HG	ND	5.67 (11.79)	5.67 (11.79)	5.69 (11.77)	5.73 (11.73)	In-accessible / unable to locate
	HF	15.00 (2.46) & 16.50 (1.16)	10.35 (7.11)	10.35 (7.11)	10.56 (6.90)	10.54 (6.92)	
BH12	MG	ND	4.62 (11.43)	4.64 (11.41)	4.82 (11.23)	4.82 (11.23)	4.82 (11.23)
	LG		17.65 (-1.60)	19.50 (-3.45)	19.39 (-3.34)	19.08 (-3.03)	15.70 (0.35)
BH13	MG	ND	1.96 (12.73)	1.94 (12.75)	Dry	NR	1.97 (12.72)
	MG/LCF	7.50 (7.19)	4.18 (10.51)	4.24 (10.45)	3.25 (11.44)		4.25 (10.44)
BH14	MG	ND	3.96 (10.24)	3.93 (10.21)	4.10 (10.10)	NR	4.04 (10.16)
	LG	26.50 (-12.30)	26.74 (-12.56)	26.60 (-12.40)	Dry		24.40 (-10.2)
BH15B	MG	ND	Dry				5.10 (9.71)
	LG	18.00 (-0.39)	13.41 (4.20)	13.41 (4.20)	13.19 (4.42)	11.72 (5.89)	6.19 (8.62)
		22.50 (-4.89)	23.10 (-5.49)	23.10 (-5.49)	23.10 (-5.49)	Dry	Dry
BH19	MG/HG	ND	3.75 (14.97)	3.80 (14.92)	3.73 (14.99)	NR	In-accessible
	LCF/HF/LG	11.00 (7.72)	7.80 (10.92)	7.56 (11.16)	NR		

BH	Strata	Strike or seepage (mbgl) (mAOD)	Monitoring Results (mbgl) (mAOD)				
			Levels provided by Waterman				
			R6	R7	R8	R9	31st October 2017
	LG	27.50 (-8.78)	21.62 (-2.90)	21.51 (-2.79)			
BH20	MG/AL /LCF	ND	5.62 (11.55)	5.75 (11.42)	NR		5.90 (11.27)
	TSF		Not monitored				17.26 (-0.09)*
BH21	MG/LCF	ND	2.84 (14.08)	2.84 (14.08)	2.98 (13.94)	3.21 (13.71)	3.20 (13.72)
	LCF/HF/LG	15.00 (1.92)	9.74 (7.18)	9.74 (7.18)	9.53 (7.39)	9.90 (7.02)	9.79 (7.13)
BH22	MG/AL	3.70 (8.19)	2.08 (9.81)	2.06 (9.83)	NR		2.07 (9.82)
BH23	MG/LCF	ND	3.50 (10.51)	3.53 (10.48)	NR		3.48 (10.53)
	LG (piezo tip)		24.26 (-10.25)	Dry			Dry
WS13	MG	ND	Not monitored				3.02 (13.95)
WS15	MG	ND					3.565 (10.60)
WS17	MG/ALL	ND					3.925 (10.47)
WS18	MG	ND					2.94 (14.37)
WS19	MG/HG	ND	Installed 1st Nov 2017				Dry
WS20	MG	ND					4.51 (11.70)
WS21	MG	ND					3.44 (11.44)
WS22	MG	ND					2.04 (10.32)
TP101	MG	2.8	Small rate of seepage				

MG= Made Ground; AL = Alluvium; HG= Hackney Gravel; LCF = London Clay Formation; HF = Harwich Formation; LG= Lambeth Group; TSF = Thanet Sand Formation
ND = not determined during drilling; NR = no record; *indicates possible erroneous water level

It can be inferred from the above table that the general groundwater table in the made ground, Alluvium and Hackney Gravel is resting at levels of between 9.54 mAOD and 14.99 mAOD, and is likely to be in hydraulic continuity (corresponding to an approximate range of 1.97m to 5.9mbgl). Shallow groundwater in the site area is anticipated to flow in a south easterly direction, i.e. towards and in the direction of the River Fleet.

In addition, sub-artesian groundwater conditions were noted within the granular horizons of the London Clay Formation, Harwich Formation and the Lambeth Group at standing levels recorded during the monitoring varying from -10.2 mAOD to 11.22 mAOD.

It is considered that locally high perched groundwater within the made ground and alluvial deposits and generally within the Hackney Gravel River may affect temporary and permanent works and that rising groundwater table due to diminishing abstraction in urban area may affect deep foundations, basements and tunnels.

Given the presence of groundwater strikes over the depth of the investigation bored piles will require either temporary casing throughout their depth or some form of support fluid. Alternatively, the use of continuous-flight-auger (CFA) injected bored piles usually overcomes this issue. It is recommended, however, that the detailed advice of a specialist-piling contractor be sought as to the most suitable type of pile for the prevailing ground conditions and as to their lengths and diameters to support the required design loads.

Based on the soil profile encountered during the investigation works, the anticipated formation level of proposed basements will be within variable but generally be on natural soils. Should the method used for basement construction be designed to effectively produce a cut-off around the perimeter of the excavation, dewatering may not be required during the construction.

Allowance should be made for hydrostatic pressures acting behind retaining structures. Furthermore, any new basement construction must be designed to be fully sealed to prevent any future groundwater ingress.

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations.

5.4 Ground gas results

The results of the ground gas monitoring and testing carried out on 31st October are provided below in **Table 18**.

Table 18: Summary of ground gas monitoring results

Borehole	Response zone/strata	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Flow rate (l/hr)	Water level (m b TOC)	Atmospheric pressure (mbar)
BH12	4.0 to 8.0 /MG	0.5	<0.1	14.8	0.2	5.90	1026
BH13	1.0 to 2.0/MG	<0.1	0.1	18.5	0	1.97	

Borehole	Response zone/strata	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Flow rate (l/hr)	Water level (m b TOC)	Atmospheric pressure (mbar)
BH14	2.0 to 6.0/MG	<0.1	0.1	18.6	0	4.04	
BH15	2.0 to 5.0/MG	<0.1	<0.1	17.5	0	5.10	
BH20	4.0 to 7.5/ MG-HG-LCF	0.1	<0.1	<0.1	0	5.90	
BH21	1.0 to 4.5/ MG-LCF	0.1	1.6	17.5	0.1	3.20	
BH22	1.0 to 4.0/MG-AL	<0.1	1.9	15.6	0	2.07	
BH23	3.0 to 6.0/ MG-LCF	<0.1	0.8	18.1	0	3.48	
WS13	1.0 to 3.0/MG	<0.1	1.5	18.2	0	3.02	
WS15	1.0 to 4.0/MG	<0.1	<0.1	18.7	0	3.57	
WS17	1.0 to 5.0/MG	<0.1	5.6	13.7	0	3.93	
WS18	1.0 to 3.0/MG	<0.1	2.3	16.8	0	2.94	

MG= Made Ground; AL = Alluvium; HG= Hackney Gravel; LCF = London Clay Formation;
ND = not determined during drilling; NR = no record

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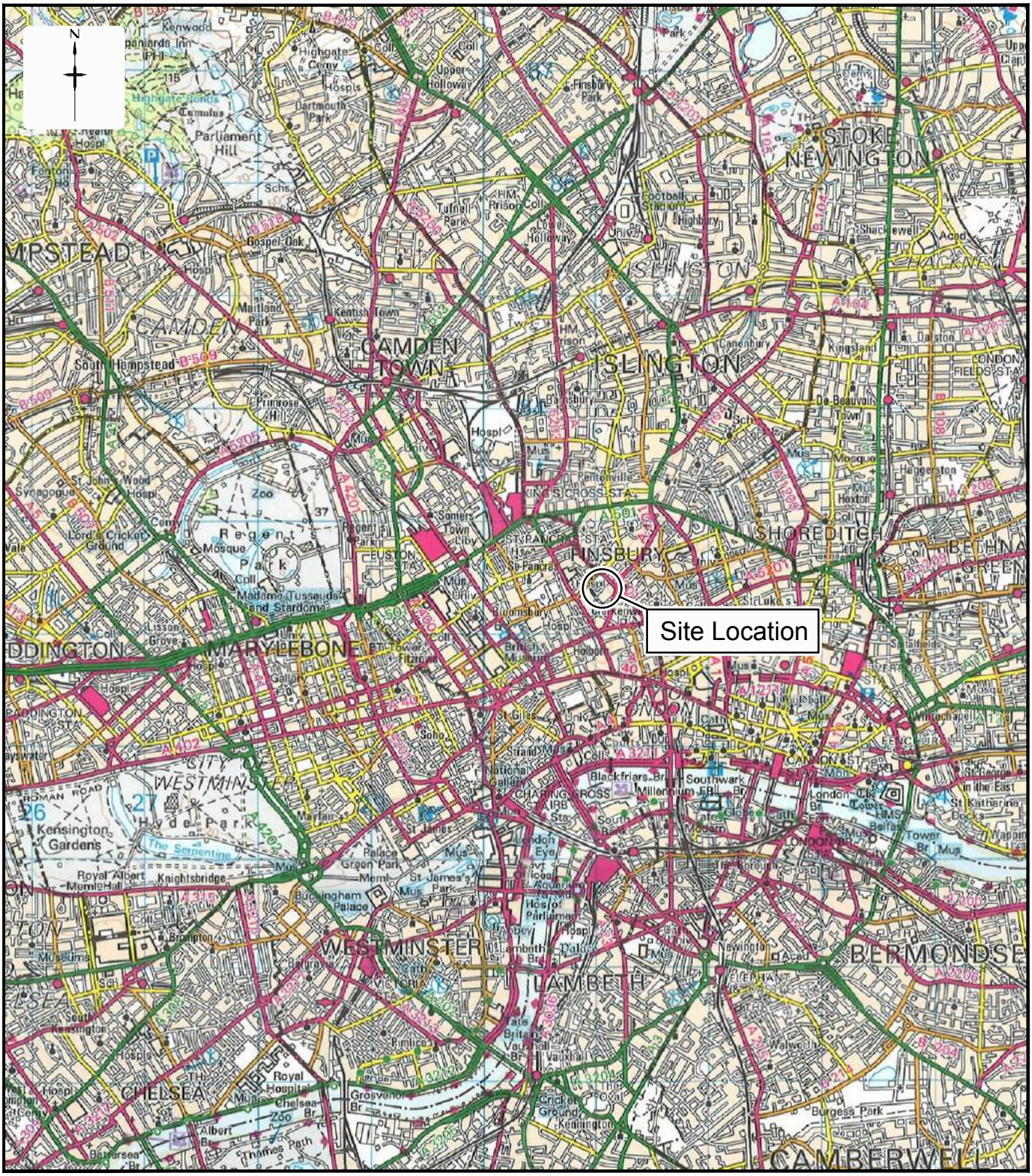
FIGURES



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Client: TAYLOR WIMPEY CENTRAL LONDON

Project Title: ADDITIONAL SITE INVESTIGATION
- MOUNT PLEASANT PHEONIX PLACE SITE

Drawing Title: SITE LOCATION PLAN

Rev	Drawn	Date	Checked	Date	Approved	Date
01	ASC	08.11.17	ST	08.11.17	ST	08.11.17

Dimensions	Scale	Original Size
m	1:50,000	A4

Project Number	Drawing File	Drawing Number
29518 - R01 (00)	29518 - SLP.dwg	FIGURE 1

LEGEND

Site Boundary

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client

TAYLOR WIMPEY
CENTRAL LONDON

Project Title

ADDITIONAL SITE INVESTIGATION
-MOUNT PLEASANT
PHOENIX PLACE SITE

Drawing Title

EXISTING
SITE
LAYOUT

Drawn	Date	Checked	Date	Approved	Date
ASC	08.11.17	ST	08.11.17	ST	08.11.17

Scale	Orig Size	Dimensions
1:1000	A3	m

Project No.	Drawing File
29518 - R01 (00)	29518 (R01-00) Fig 2.dwg

Drawing No.	Rev.
FIGURE 2	P1

Scale

0 10 20 30 40 50m

N

LEGEND

Site Boundary

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Project Title

ADDITIONAL SITE INVESTIGATION
-MOUNT PLEASANT
PHOENIX PLACE SITE

Drawing Title

PROPOSED
DEVELOPMENT
LAYOUT PLAN

Drawn	Date	Checked	Date	Approved	Date
ASC	08.11.17	ST	08.11.17	ST	08.11.17

Scale	Orig Size	Dimensions
1:1000	A3	m

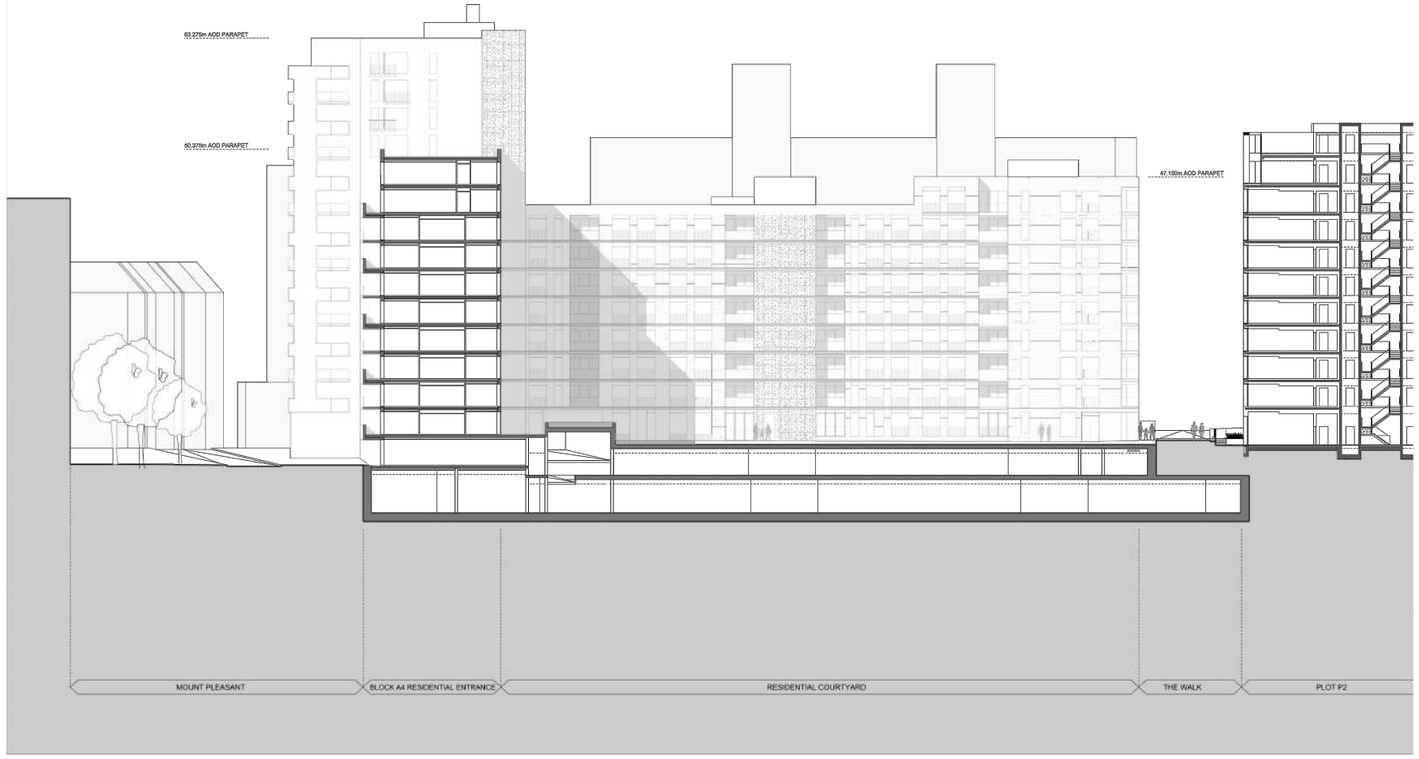
Project No.	Drawing File
29518 - R01 (00)	29518 (R01-00) Fig 3.dwg

Drawing No.	Rev.
FIGURE 3	P1

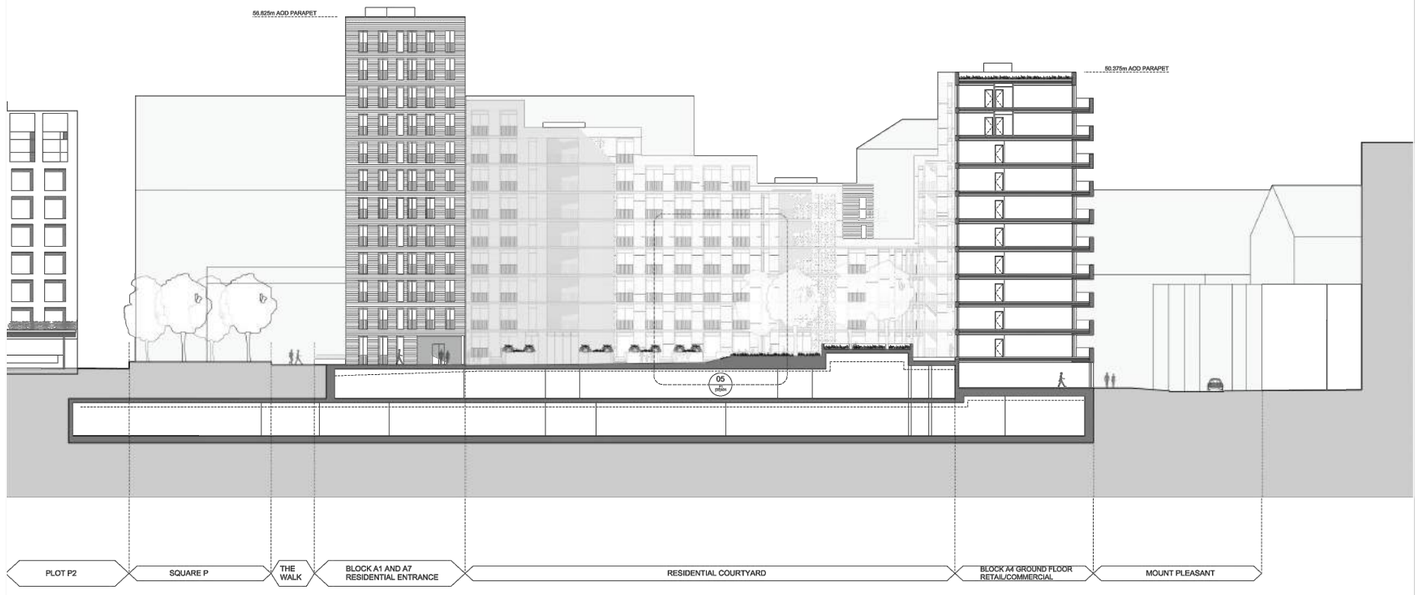
Scale

0 10 20 30 40 50m

Block A Proposed Sections Courtyard (West)



Block A Proposed Sections Courtyard (East)



LEGEND

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Project Title

ADDITIONAL SITE INVESTIGATION
-MOUNT PLEASANT
PHOENIX PLACE SITE

Drawing Title

PROPOSED
DEVELOPMENT
ELEVATION PLAN

Drawn	Date	Checked	Date	Approved	Date
ASC	08.11.17	ST	08.11.17	ST	08.11.17

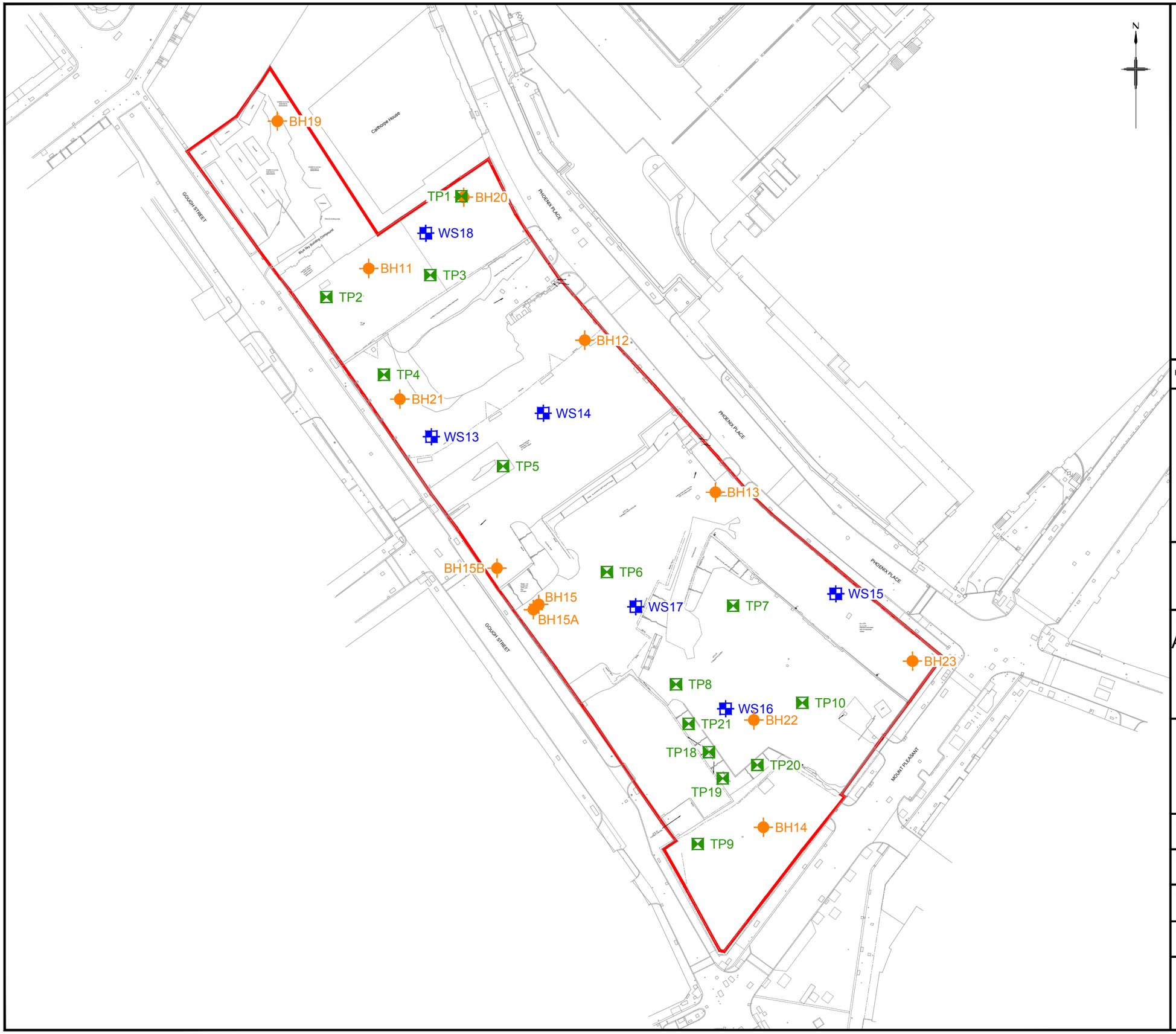
Scale	Orig Size	Dimensions
1:1000	A3	m

Project No.	Drawing File
29518 - R01 (00)	29518 (R01-00) Fig 4.dwg

Drawing No.	Rev.
FIGURE 4	P1

Scale

0 10 20 30 40 50m



LEGEND

- Site Boundary
- Cable Percussive Borehole Location
- Window Sample Borehole Location
- Machine Excavated Trial Pit Location

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Project Title

ADDITIONAL SITE INVESTIGATION
-MOUNT PLEASANT
PHOENIX PLACE SITE

Drawing Title

PREVIOUS RSK INVESTIGATION
EXPLORATORY HOLE
LOCATION PLAN (2016)

Drawn	Date	Checked	Date	Approved	Date
ASC	08.11.17	ST	08.11.17	ST	08.11.17

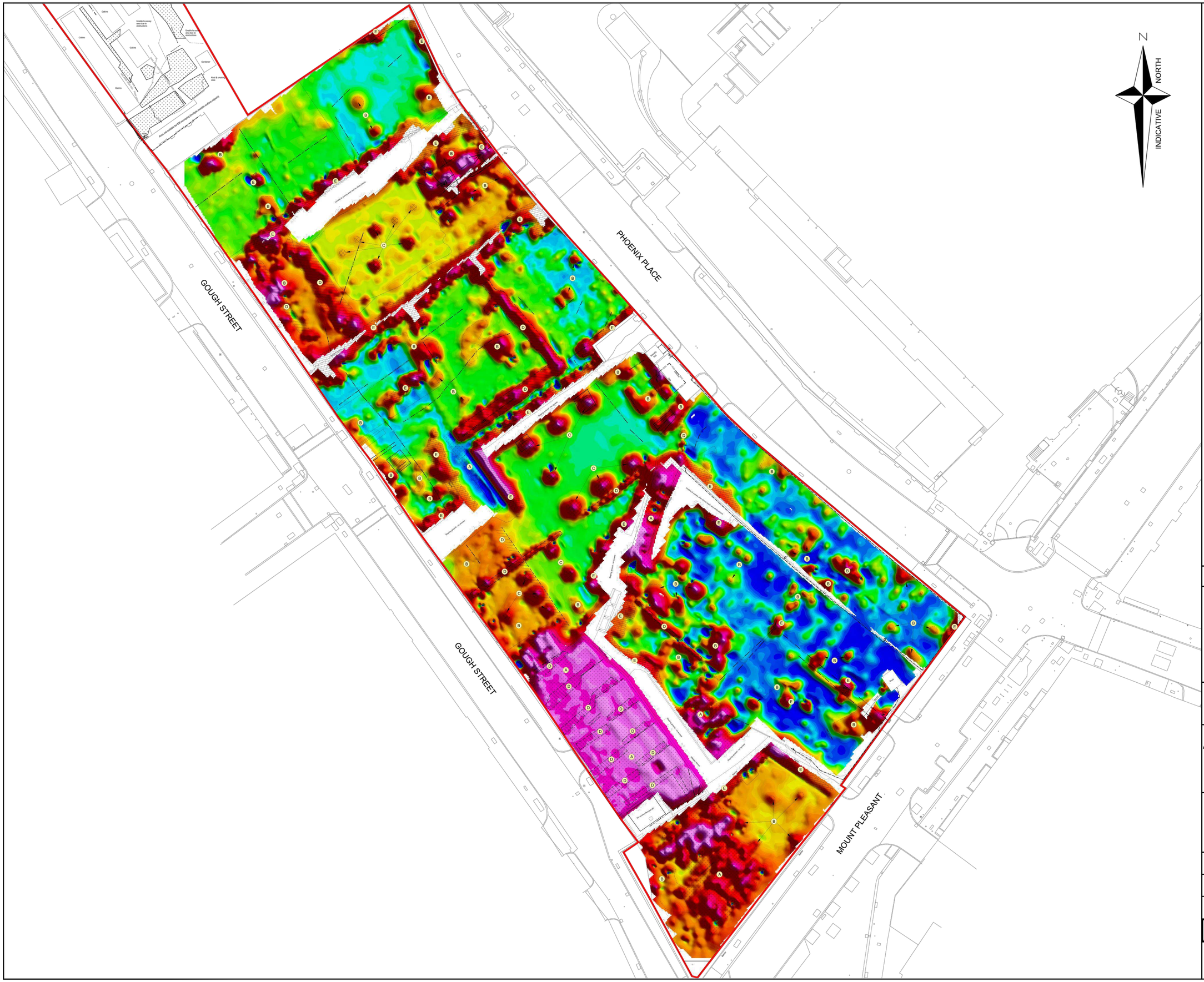
Scale	Orig Size	Dimensions
1:1000	A3	m

Project No.	Drawing File
29518 - R01 (00)	29518 (R01-00) Fig 5.dwg

Drawing No.	Rev.
FIGURE 5	P1

Scale 1 : 800

0 10 20 30 40 50 60m



NOTES:

The specific risks associated with the content of this drawing are considered to be:-

(1) The topographical baseplan has been supplied by the client and has not been checked for accuracy.
(2) EM data positioned using dGPS.
(3) EM data gridded and contoured using Oasis Montaj v7.

KEY AND INTERPRETATION

GEOPHYSICAL SURVEY AREA EXTENTS

EM ANOMALY TYPE A
EM AND GPR DETECTED METAL REINFORCEMENT BARS IN CONCRETE SLAB

EM ANOMALY TYPE B
EM DETECTED PROBABLE BURIED METALLIC OBSTRUCTIONS

EM ANOMALY TYPE C
EM DETECTED POSSIBLE FOUNDATIONS

EM ANOMALY TYPE D
EM DETECTED METALLIC LINEAR FEATURES - POSSIBLE BURIED SERVICE OR BURIED SRUCTURE

EM ANOMALY TYPE E
LIKELY SATURATION/INTERFERENCE FROM ABOVE GROUND METALLIC FEATURES

BUILDING/FENCE
GULLY (G)
INSPECTION COVER (IC)
SERVICES & STREET FURNITURE

FEATURES FROM PAS 128 GPR UTILITY SURVEY:

DRAINAGE COMBINED WATER
DRAINAGE FOUL WATER
DRAINAGE SURFACE WATER
ELECTRIC
GAS
METALLIC
TRAFFIC CONTROLS
WATER
GPR LINEAR FEATURE (POSSIBLE SERVICE)

9109
7816
6496
4211
2587
1868
1447
1155
945
763
658
548
453
376
315
267
229
195
167
143
124
106
92
79
68
59
50
41
33
25
18
9
1
-16
-49
-79
-109
-140

EM61 CHANNEL 1 RESPONSE (mV)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Project Title
ADDITIONAL SITE INVESTIGATION - MOUNT PLEASANT PHOENIX PLACE

Drawing Title
TDIEM DATA PHOENIX PLACE (EM61, CHANNEL 1)

Drawn	Date	Checked	Date	Approved	Date
ASC	08.11.17	ST	08.11.17	ST	08.11.17

Scale	Orig Size	Dimensions
1:150	A1	m

Project No.	Drawing File
29518 - R01 (00)	29518 (R01-00) Fig 6A.dwg

Drawing No.	Rev.
FIGURE 6A	P1

Scale 1 : 150
0 2 4 6 8 10m