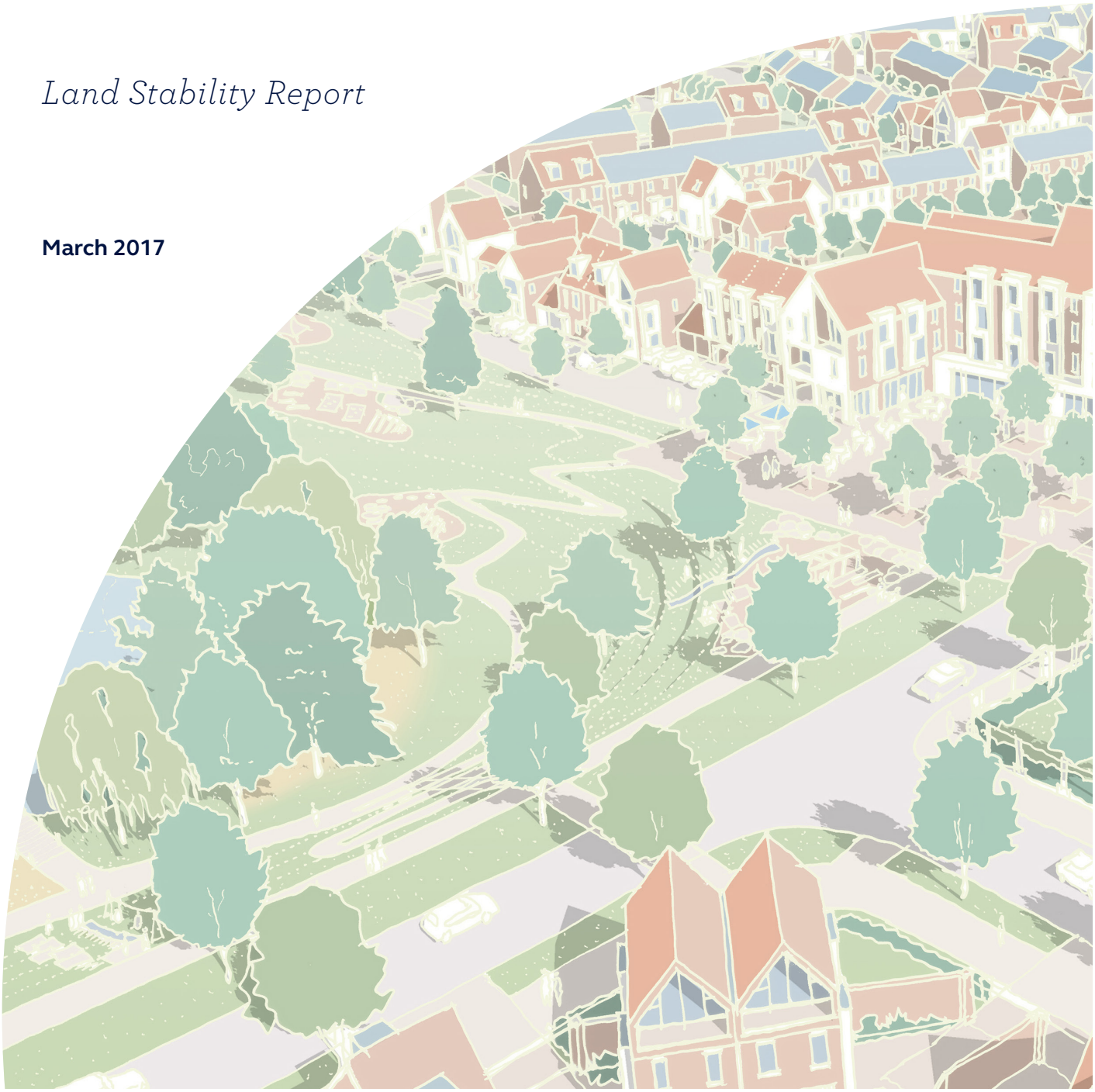
CARLYLE LAND
LIMITED

Land south and east of Adastral Park

Suffolk

Land Stability Report

March 2017



Document Control Sheet

Document Title: Land Stability Report

Document Ref: 10391/LSR/01

Project Name: Land South and East of Adastral Park

Project Number: 10391

Client: Carlyle Land Ltd and Commercial Estates Group

Document Status

Rev	Issue Status	Prepared / Date	Checked / Date	Approved / Date
0	Draft	L Witts 24/03/17	L Witts 24/03/17	P Boileau 24/03/17
1	Final	L Witts 28/03/17	L Witts 28/03/17	P Boileau 28/03/17

Issue Record

Name / Date & Revision	24/03/17	28/03/17				
David Lewis (CEG)	0	1				

Contents

Appendix

1 Introduction

1.1 Brookbanks Consulting Ltd is appointed by Carlyle Land Ltd and Commercial Estates Group to complete a Land Stability Report to support a planning application for development on land south and east of Adastral Park, Ipswich.

1.2 The Report considers the suitability of existing ground conditions to form, through earthworks, the development platforms necessary to facilitate viable development at the site.

2 Background Information

Location & Details

2.1 The proposed development Site boundary measures an area of approximately 113.3ha and is situated on land to the south and east of Adastral park (BT's research and development campus). The Site is bound to the west by the A12 and to the north-west by Barracks Square, Gloster Road and Belts Avenue, which form boundaries to Adastral Park. The south of the Site is bound by Newbourne Road and Ipswich Road, with the east of the Site bound a by a footpath which separates the current surrounding agricultural land. The majority of the site is or has been used for sand and gravel extraction.

2.2 The proposed development area is outlined in red, as shown on Figure 2a, below:

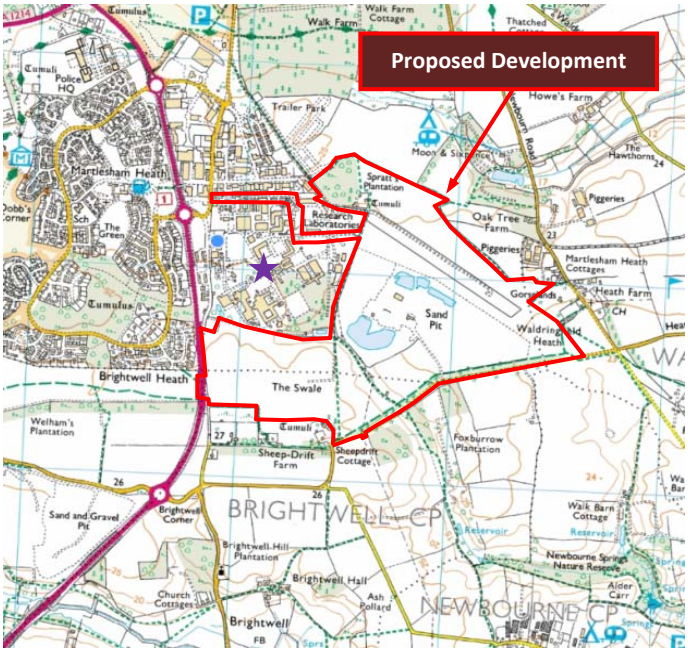


Figure 2a: Site Location

Development Criteria

2.3 Outline application for up to 2,000 dwellings, an employment area of c0.6ha (use Class B1), primary local centre (comprising use classes A1, A2, A3, A4, A5, B1, C3, D1 and D2), secondary centre (comprising possible use Classes A1, A3, A5 and D2), a school, green infrastructure (including Suitable Accessible Natural Green Space (SANGS), outdoor play areas, sports ground and allotments/community orchards), public footpaths and cycleways, vehicle accesses and associated infrastructure.

3 Recent & Current Site Usage

3.1 Since the 1960's mineral extraction has taken place within the area of the proposed development. Brett Aggregates currently lease a vast majority of the proposed Site for mineral extraction along with concrete mixing and subsequent inert landfilling activities. The mineral extraction works on site has resulted in the creation of a number of large ponds. Sheep Drift Farm lease the remaining areas which are used for agricultural purposes. The extent of the extraction works and location of the ponds can be seen below on Figure 3a:

Figure 3a: Google Map Image, 2016

3.2 From previous work undertaken, the Suffolk County Council Minerals Plan states that the area currently used as agricultural land is a ''preferred option'' for mineral extraction. A number of areas have also previously been identified which have potential to be used for sand and gravel extraction. Two main areas in the south west and north east of the boundary have been identified as areas which have yet to be extracted. It was previously proposed to phase the extraction to enable parts of the proposed development to be built, whilst the extraction works are undertaken, minimising potential impacts on new receptors.

3.3 An Extraction Programme was previously produced which outlined a five-stage phasing plan. The Programme outlines a plan of individual Phases along with Brett Occupation Start date, Brett Completion (with the earliest Handover to BT), Tonnage to be extracted and overall area. This is summarised in the Table 3b, and illustrated in Figure 3c.

Phase		Brett Occupation Starts	Brett Completion – Earliest Handover to BT	Tonnage to be Extracted (approx.)	Area (Ha)
1		N/A	N/A	N/A	4.76
2A		3rd January 2012	5th November 2014	200,000	6.43
2B	**1**	3rd January 2012	4th September 2014	426,000	2.66
	2	3rd January 2012	3rd December 2015		4.23
	3	3rd January 2012	4th April 2017		5.26
3		3rd January 2017	3rd April 2020	357,000	20.81
4		3rd January 2020	3rd April 2024	513,000	25.24
5A		4th April 2015	4th April 2025	163,000	5.55
5B		Now	4th April 2026		14.03

Table 3b: Mineral Extraction Programme (Sourced from David Lock Associates - 2011)

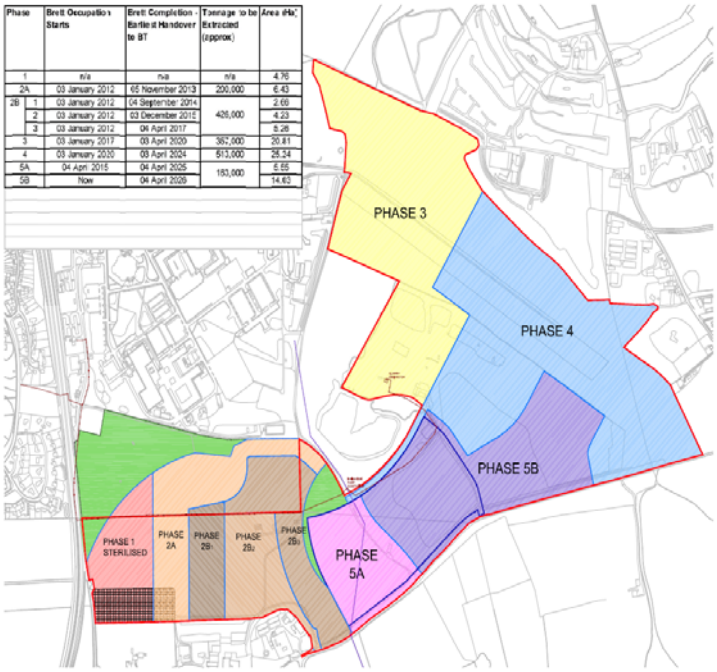


Figure 3c: Mineral Extraction Programme (Sourced from David Lock Associates - 2011)

3.4 Figure 3c is an extract from the previous desktop study undertaken by Environ in 2007 for the Site which indicates there are a number of potential contaminant sources on site (such as fuel tanks, a former landfill and the mineral washing plant). It was also reported that the site was part of the former RAF and US Army Airforce Airfield between 1917 and 1963. It has therefore been considered necessary to carry out further UXO (Unexploded Ordnance Survey) Risk Assessment work for the Site, which is further detailed in Section 8.

3.5 Also included within the Environ report is a summary of the main buildings and structures associated with Brett Aggregates, which is as follows:

*"**Administration Building**: the first building encountered at the end of the access road is a single storey structure housing the site's administrative activities. The building is reportedly provided with electrically powered heaters and does not currently, nor did it historically, house any chemical storage. The building is located in the central site area;*

***Warehouse**: a high bay single storey, brick constructed building, with corrugated sheet roofing and cladding, is present to the north west of the Admin Building. Historically, this building was used for the maintenance of Brett's fleet of HGV vehicles.*

Presently, the building is rarely used, although chemical and bulk fuel storage was noted internally and externally within the vicinity of the building;

***Emergency Generator House**: a single storey, brick outbuilding, is present to the south of the Warehouse and west of the Admin Building. This building houses one redundant and one operational, diesel powered emergency generator. The diesel fuel supply is present externally, adjacent to the east of the building;*

***Mineral Washing Plant**: Extracted minerals are washed (water only) in the plant located to the north of the Admin Building and to the east of the Warehouse. The plant consists of an electrically powered conveyor belt, a cylindrical water tank and a hopper / large skip;*

***Concrete Mixing Plant**: The plant is located to the south west of the emergency generator house and to the north of the leisure pond. Concrete is stored in silos, and combined with water and additives to create cement, which is then distributed to awaiting HGV vehicles.*

The wastewater settling lagoons are located to the north of the warehouse and admin buildings, with the currently operational landfilling area located to the east south-east of the lagoons."

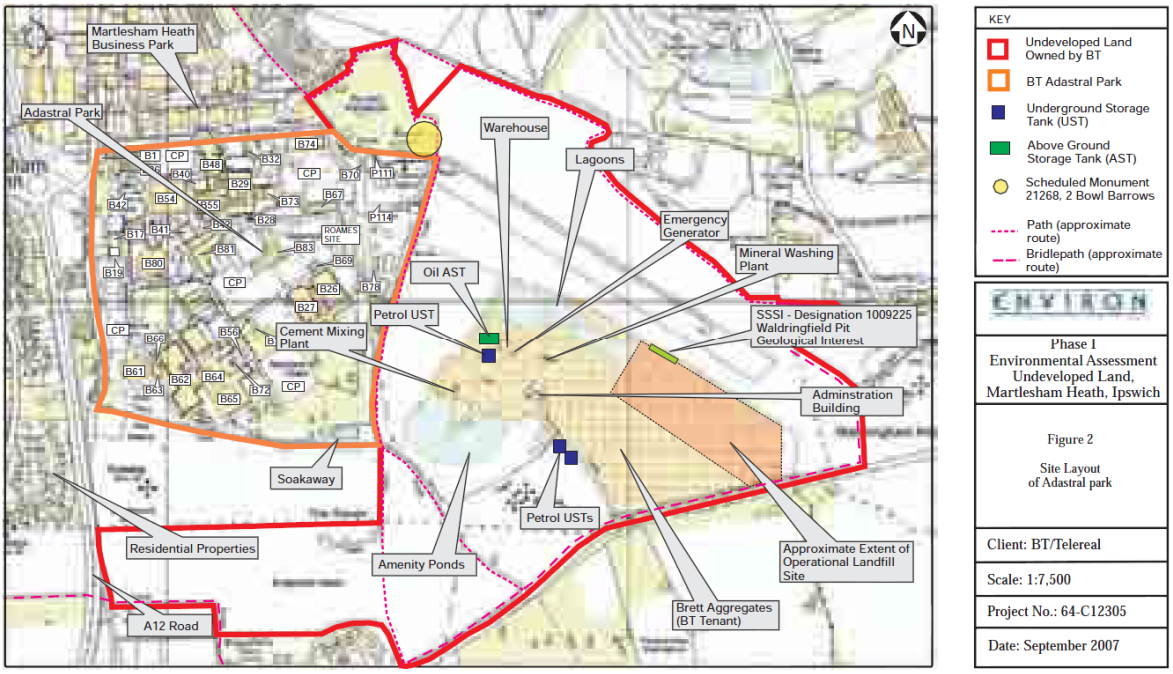


Figure 3d: Phase 1 Environmental Assessment (Sourced from Environ - 2007)

4 Ground Conditions

Geology

4.1 With reference to the British Geological Survey map, the Site is shown to be underlain by bedrock geology comprising sand from the Crag Formation, with areas of overlying superficial deposits of sand and gravel belonging to the Kesgrave Catchment Subgroup.

4.2 There is no Artificial Ground/ Made Ground or Landslip areas reported on Site.

4.3 The Site geology, as described above is illustrated on Figure 4a:

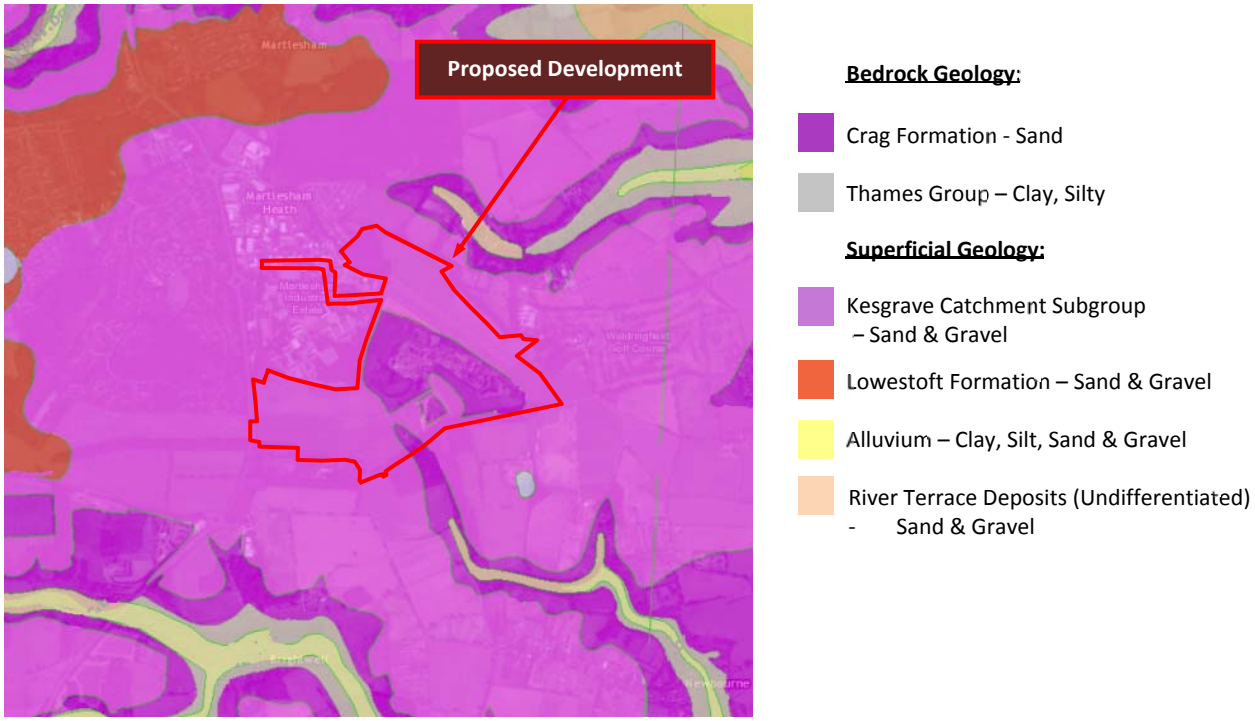


Figure 4a: BGS Published Geology

4.4 Similarly, a geological cross section through the Site was produced in a previous Earthworks Strategy, by WSP Consultants. Figure 4b, is an extract of the diagram which illustrates the underlying geology across the extent of the Site.

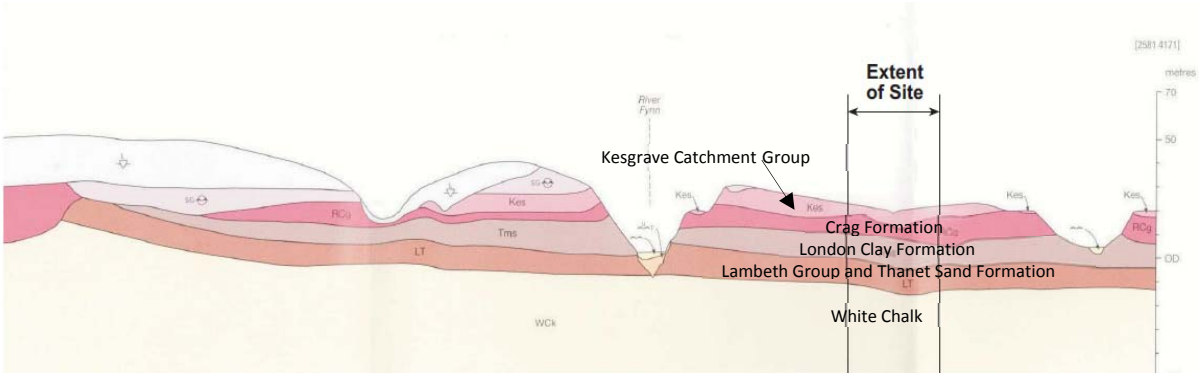


Figure 4b: Modified Geological Cross Section, 2009 (Sourced from WSP, based on Ordinance Survey map)

4.5 BGS records include the following ratings for a number of potential ground stability hazards on or within 250m of the Site boundary:

- Collapsible ground stability: No Hazard*/Very Low*
- Compressible ground: No Hazard*/Low*
- Ground Dissolution: No Hazard*
- Landslide: Very Low*
- Running Sand: No Hazard/ Very Low*/Low*
- Shrinking & Swelling Clay: No Hazard*/ Very Low*

*potential ground stability hazard on Site

5 Proposed Development and Earthworks Design

5.1 In line with the development description outlined in Section 2.3, an Illustrative Framework Masterplan has been produced to visualise the aspirations of the site layout.

5.2 Brett Aggregates have been recently consulted on, and a revision of their phased extraction programme as been agreed to be in coordination with the proposed delivery of residential units.

5.3 In support of the Illustrative Framework Masterplan, a 3D topographical survey of the site environment was carried out in December 2016. This also captured the state of the mineral extraction sequence currently being carried out by Brett Aggregates.

5.4 In order to establish what necessary earthworks there will be to remediate against the mineral extraction works, a preliminary earthworks plan was produced and is included within the Appendix. In general terms, the earthworks strategy has been designed in response to:

- Achieving a cut and fill balance across the site.
- Positively utilising the surplus topsoil and subsoil generated by the mineral extraction works.
- Forming suitable development platforms which complement the Illustrative Framework Masterplan.
- Forming suitable bunds for use as noise attenuation, within the noise sensitive locations of the site.

5.5 The earthworks proposals offered provide an outline strategy for how the development can be delivered. It must be noted that further mineral extraction works could alter the proposals, but can be positively addressed at the detailed design and phased delivery stage of the development.

6 Land Stability

6.1 As established by the British Geological Survey records for the ground materials contained within this site, the results concluded that there is either a ‘low’, ‘very low’ or ‘no hazard’ classification for potential of ground stability hazards.

6.2 Further, Commercial Estates Group commissioned Wardell Armstrong to complete a visual inspection, geotechnical and laboratory analysis exercise to determine the suitability of the ground materials for use in development. A copy of this report can be found in the Appendix.

6.3 In summary, the sampled materials taken from the site confirmed that they comply with the grading requirements defined in the UK Specification for Highways Works (600 Series) and would be classified as 1A Material. 1A Material is defined as Well Graded Granular Material, with the typical use being as ‘general fill’.

6.4 Utilising industry standard placement and compaction methods, type 1A Material is nationally and formally recognised as material which has acceptable properties for development platforming.

6.5 Having established that the site material is suitable as engineering fill, a specification must be produced, to inform the detailed design and tendering of earthworks, in order to physically complete the earthworks exercise to the relevant British Standards.

6.6 Geo Environmental Group produced a site-specific Earthworks Specification in July 2016, which is contained within the Appendix. This Earthworks Specification sets out the best practice guidance for placement and compaction of the existing ground, classified as engineering fill. Section 4 of the specification sets out the specific requirements for backfilling and compaction of the material which will achieve the development platform levels.

6.7 It is the intention that this Earthworks Specification is brought forward through the life of the development and anchors the detailed design, tendering, construction and testing of the earthworks strategy.

7 Summary

7.1 The platform levels identified in the Appendix are easily achievable with the material present on site.

7.2 Following completion of a robust assessment and testing, the land material is sufficiently stable to accommodate development (with applicable monitoring during construction).

7.3 The phasing delivery of Brett Aggregates extraction has been changed to match the phasing delivery of residential development.

8 Limitations

8.1 The conclusions and recommendations highlighted above are based on all available background information for the site and all design solutions are based upon the planned usage of the site.

8.2 Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

8.3 The benefits of this report are provided solely to Carlyle Land Ltd and Commercial Estates Group. for the Proposed Development on Land south and east of Adastral Park in Martlesham near Ipswich, Suffolk.

8.4 Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

Appendix 1 – Brookbanks Drawing 10391 – EW - 01

Original Drawing Size A1

Land south and east of Adastral Park
PRELIMINARY EARTHWORKS SCHEDULE

ELEMENT	Plan Area (ha)	Topsoil Strip (m3) *	Cut (m3)	Fill (m3)	Topsoiling Depth (m)	Topsoiling Re-Use (m3)**	Site Arisings (m3) ***
Residential Areas	64.8	32,400	1,240	150,400	0	0	129,600
Employment/Commercial	0.6	300	865	98,600	0	0	1,200
School Site	5.5	2,750	770	12,670	0.2	11,000	11,000
Existing Stockpiled Bunds	4.9	2,450	111,900	0	0.3	14,700	0
SUDS (Soakaway Drainage)	2.7	1,350	23,000	0	0.15	4,050	0
New Noise Bunds	0.96	0	0	17,400	0.15	1,440	0
TOTAL		39,250	137,775	279,070		31,190	141,800

TOTAL CUT + ARISINGS =	279,575		
TOTAL FILL =	279,070		
EARTHWORKS BALANCE = TOTAL CUT - TOTAL FILL			
EARTHWORKS BALANCE =	505 cu m	SURPLUS =>	TO BALANCE SUBSOIL RAISE FFL'S BY (mm) = 0.08
TOPSOIL BALANCE =	8,060 cu m	SURPLUS =>	REUSE SURPLUS TOPSOIL ON OPEN SPACES OR EXPORT OFFS

* Based on 0.3m depth from findings during investigation work
**100% re-use on landscaped areas, 50% re-use on built development
***Site arisings based on 2,000cu m per ha (Derived from recent experience on similar sites)

Enabling Infrastructure Subsoil Management Strategy

Subsoil arisings from SUDS used as fill for site access

Surplus material from SUDS plus subsoil from infrastructure works to be stockpiled in landscaped area

'House Build' Subsoil Management Strategy

Subsoil arisings from development parcels to be used for noise bund

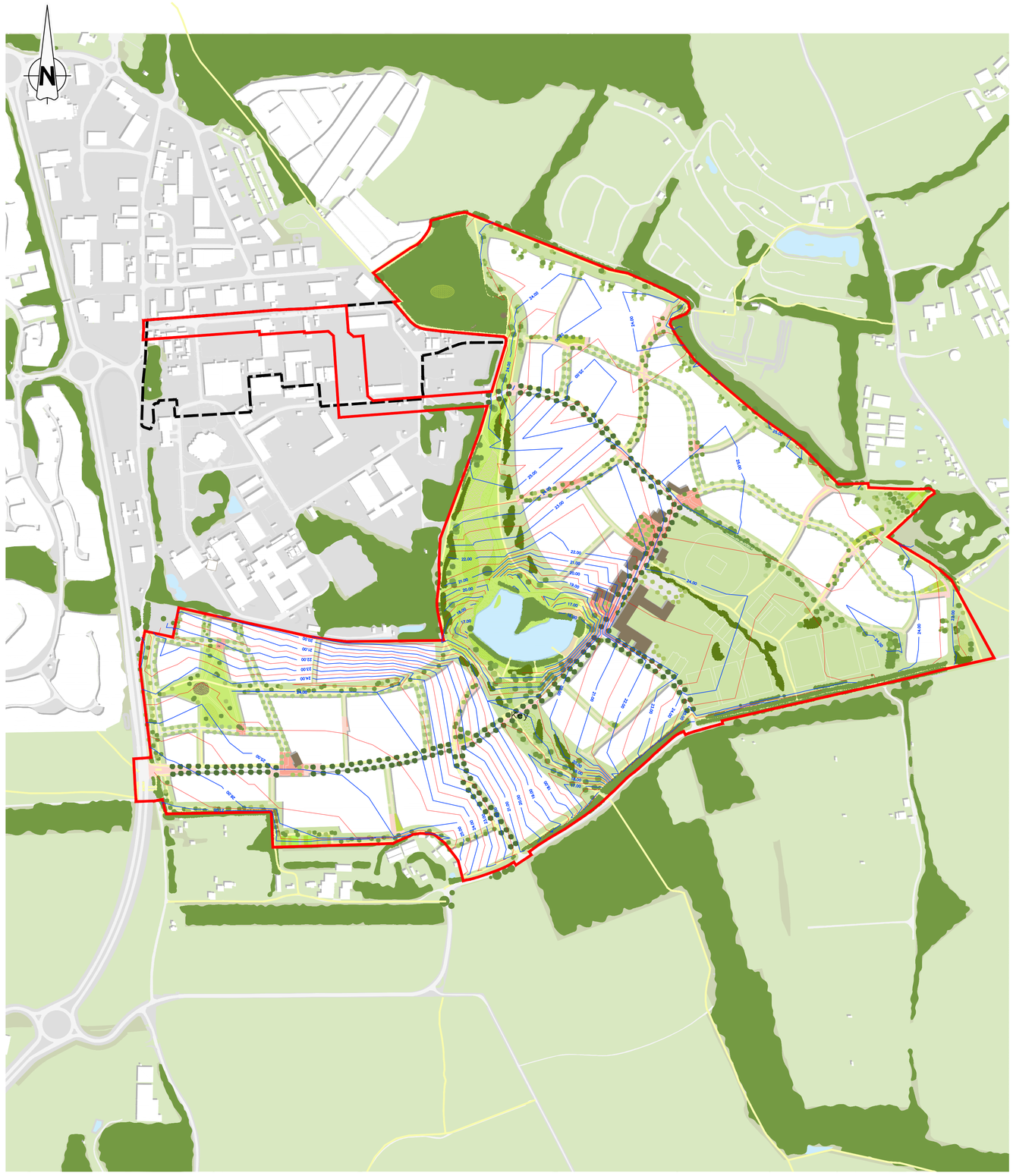
FFL's to be raised locally to accomodate surplus material

Surplus material to be exported from site

Topsoil Management Strategy

Topsoil strip from highway works stockpiled within landscaped area. Topsoil from development parcels to be stockpiled within parcels for re-use

Topsoil to be re-used as required on open spaces



NOTES:

1. Do not scale from this drawing.
2. All dimensions in metres unless otherwise stated.
3. Brookbanks Consulting Ltd has prepared this drawing for the sole use of the client. The drawing may not be relied upon by any other party without the express agreement of the client and Brookbanks Consulting Ltd. Where any data supplied by the client or from other sources has been used, it has been assumed that the information is correct. No responsibility can be accepted by Brookbanks Consulting Ltd for inaccuracies in the data supplied by any other party. The drawing has been produced based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.
4. No part of this drawing may be copied or duplicated without the express permission of Brookbanks Consulting.
5. All materials, workmanship and highway construction works to be in accordance with the contract specification, and Specification for Highway Works.
6. All planting in visibility splays to be agreed and approved by the Engineer and in all cases no planting to be above 600mm in height above the carriageway. Also no obstructions of any kind within the visibility splay areas.
7. All Brookbanks Consulting drawings should also be read in conjunction with any drawings produced by third parties connected with this project.
8. All works within existing Public Highway, including any temporary works or traffic management measures, are subject to the approval of Suffolk County Council. When works are required on the Public Highway, the Contractor shall liaise with and obtain all Statutory Approvals from SCC Council, before commencing these works. These approvals include, but are not limited to, approval of traffic management measures, issue of works commencement notices, road opening notices, temporary traffic regulation orders etc.
9. All traffic management shall comply with the requirements as set out in Chapter 8 of the Traffic Signs Manual. Warning signs may be erected outside the indicated boundaries. Any obstructions to traffic or pedestrians shall be properly signed and protected with barriers, cones, signs, and lamps.
10. All tactile areas to be laid in accordance with DETR "Guidance on the use of tactile paving surfaces".
11. All traffic signs and road markings are to be in accordance with the 'Traffic Signs Regulations and General Directions 2002'.
12. Highway Inspector to be present during inspections / CBR testing.
13. Earthworks details on this drawing are for information only and not for construction.

NOTES:

Proposed Finished Level Contours

NOTE: This earthworks volumetric strategy is offered as preliminary advice only. The specific details of cut and fill, locations for stockpiling, borrow pits and topsoil placements are dependant upon the phasing of delivery of the site, which is to be finalised.

Brookbanks
6150 Knights Court Solihull Parkway Birmingham B37 7WY
Tel (0121) 329 4330 Fax (0121) 329 4331
www.brookbanks.com

Carlyle Land Ltd and
Commercial Estates Group

Land at south and east of
Adastral Park

Earthworks Strategy Plan
(Preliminary)

Status		Status Date
Preliminary		Mar 2017
Drawn	Checked	Date
MM	LW	24.03.2017
Scale	Number	Rev
NTS	10391-EW-01	-

0 40 80 120 160 200
METRES

Appendix 2 – Wardell Armstrong Letter & Laboratory Report – 10th August 2016

Wardell Armstrong
Sir Henry Doulton House, Forge Lane, Etruria, Stoke-on-Trent, ST1 5BD, United Kingdom
Telephone: +44 (0)845 111 7777 Facsimile: +44 (0)845 111 8888 www.wardell-armstrong.com

wardell armstrong
your earth our world

Our ref: DH/RB/SL/ST15659/0001

Date: 10 August 2016

BY EMAIL

Mr P Dyke
Commercial Estates Group Ltd
No 1 Leeds
26 Whitehall Road
Leeds
LS12 1BE

Dear Mr Dyke

Suitability of Earthworks at Land off Adastral Park, Ipswich

Further to our email dated 02 August 2016, please find below an assessment of the suitability of natural superficial materials for earthworks at the land off Adastral Park, Ipswich.

Wardell Armstrong have undertaken a site inspection and geotechnical analysis to determine the initial viability of site won material for use in engineering fill. It is understood that an urgent preliminary assessment of the potential to re-use the natural superficial deposits in regrading works is required to inform a forthcoming land purchase. We trust that the following is sufficient given the time and budget available.

Materials Assessment
In order to determine the initial feasibility of materials for earthworks Wardell Armstrong has taken two samples from the site, which have been analysed for geotechnical properties. Samples were tested for Particle Size Distribution, Moisture Content, Maximum Dry Density and Optimum Moisture Content.

The site is a significant size and therefore this very limited sampling and preliminary visual inspection cannot necessarily be deemed to be representative of the whole of the natural superficial deposits across the site. Where observed, the superficial deposits on site comprised 'Light brown slightly silty SAND AND GRAVEL. The sand is medium to coarse and the gravel is fine to coarse, rounded sandstone.' Nevertheless, it is likely that some variability in the nature of the ground will be present, including potential areas of unrecorded made ground.

Samples were analysed by Chelmer Geotechnical Laboratories, a copy of the results are enclosed. The laboratory analysis has identified that the materials comply with the grading requirements defined in the UK Speciation for Highways Works (Series 600 earthworks), and would be classed as a **1A Material**. 1A Material is defined as Well Graded Granular Material, with the typical use being as general fill.

The laboratory analysis has also identified that the Optimum Moisture Content of the material sampled would be c.7.5%.

Site Inspection
A site inspection was undertaken to identify any obvious visual overarching issues that may affect the suitability of the earthworks at the site, summarised below.

Open faces of excavations were inspected to determine variability in the natural superficial deposits. Where these were inspected the materials were generally the same as the material sampled (sand and gravel). However, some areas were siltier and some strata contained lenses up to 300mm of firm sandy clay.

This area will require investigation to assess its suitability for redevelopment and to assess any potential reclamation requirements.

No unacceptable materials (as defined in the UK Specification for Highway Works, e.g. peat, oversized, deleterious material) were observed within the natural superficial deposits during the site inspection.

The site manager indicated during the inspection that an abstraction pond for the silt lagoons was recharged using groundwater. The level of this abstraction pond was c.7m below existing ground level.

The site manager also indicated that the area in the south east of the site ('Phase 5b') had been previously restored using construction rubble and inert waste.

Conclusions and Recommendations
Wardell Armstrong have undertaken preliminary sampling of natural superficial deposits at the land off Adastral Park, Ipswich. A visual inspection was undertaken which has identified no overarching constraints to earthworks on the site, and has confirmed that the materials sampled are representative of those encountered site wide.

Geotechnical analysis of samples has identified that the materials comply with the UK Specification for Highways Works (Series 600 Earthworks) and are considered to be Class 1A, 'Well Graded Granular Material'; with an optimum moisture content of c.7.5%

Based on the aforementioned information it is likely that the natural superficial deposits on site would be suitable for use as engineering fill material.

No testing or inspection has been undertaken on the imported material on site, further testing would be required to determine the suitability of this material, and determine if processing of the material is required.

Earthworks on site should be undertaken in accordance with a specification approved by the relevant authority, which would require additional sampling and analysis.

Yours sincerely
for Wardell Armstrong LLP

D G HASSALL
Environmental Geologist
dhassall@wardell-armstrong.com
Enc

UKAS TESTING
8284

Chelmer
Geotechnical Laboratories
'Groundbreaking Services'

Laboratory Report

Site	Brett Aggregates Ltd, Waldringfield, Quarry Brightwell, Brightwell, Ipswich, IP10 0BL
Client	Wardell Armstrong
Date	08-Aug-16
Our Ref	CSI7439
CGL Ref	CGL7439-1

Chelmer Site Investigation Laboratories Ltd
Unit 15 East Hanningfield Industrial Estate, Old Church Road, East Hanningfield, Essex CM3 8AB
Essex: 01245 400930 | London: 0203 6409136 |info@siteinvestigations.co.uk | www.siteinvestigations.com

UKAS TESTING
8284

Chelmer
Geotechnical Laboratories

Content Summary

This report contains all test results as indicated on the test instruction/summary.

CGL Reference : CGL7439-1
Client Reference : CSI7439
For the attention of : Dan Hansell
This report comprises of the following : 1 Cover Page
1 Inside Cover/Contents Page
3 Pages of Results
2 Particle Size Distribution - Wet Sieving Charts
1 Limitations of Report Page

Notes :

General

Please refer to report summary notes for details pertaining to methods undertaken and their subsequent accreditations

Samples were supplied by Customer

All tests performed in-house unless otherwise stated

Deviant Samples

Samples were received in suitable containers	Yes
A date and time of sampling was provided	Yes
Arrived damaged and/or denatured	No

Laboratory Testing Results

BS 1377 : 1990

Chelmer Geotechnical Laboratories

Job Number : CGL7439-1
Client : Wardell Armstrong
Client Reference : CSI7439
Site Name : Brett Aggregates Ltd, Waldringfield, Quarry Brightw

Date Received : 03/08/2016
Date Testing Started : 03/08/2016
Date Testing Completed : 08/08/2016
Laboratory Used : Chelmer Geotechnical, CM3 8AB

Sample Ref			Sample Type	*Moisture Content (%) [1]	*Soil Faction > 0.425mm (%) [2]	*Liquid Limit (%) [3]	*Plastic Limit (%) [4]	*Plasticity Index (%) [5]	*Liquidity Index (%) [5]	*Modified Plasticity Index (%) [6]	*Soil Class [7]	Filter Paper Contact Time (h) [8]	*Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%) [10]	*pH Value [11]	*Sulphate Content (g/l)		
BH/TP/WS	Depth (m)	UID															SO_3 [12]	SO_4 [13]	Class [14]
-	n/a	76974	D	4	<5														
-	n/a	76975	D	6	<5														

Notes :- *UKAS Accredited Tests

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
[8] In-house method S9a adapted from BRE IP 4/93
[9] Values of shear strength were determined in situ by Chelmer Site Investigations using a Pilcon hand vane or Geonor vane (GV).
[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005

Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key
D - Disturbed sample
B - Bulk sample
U - U100 (undisturbed sample)
W - Water sample
ENP - Essentially Non-Plastic
U/S - Underside Foundation

UKAS TESTING
8284

Comments :-

Technician :- MG
Checked By :- SG
Date Checked :- 10-Aug-16

Laboratory Testing Results

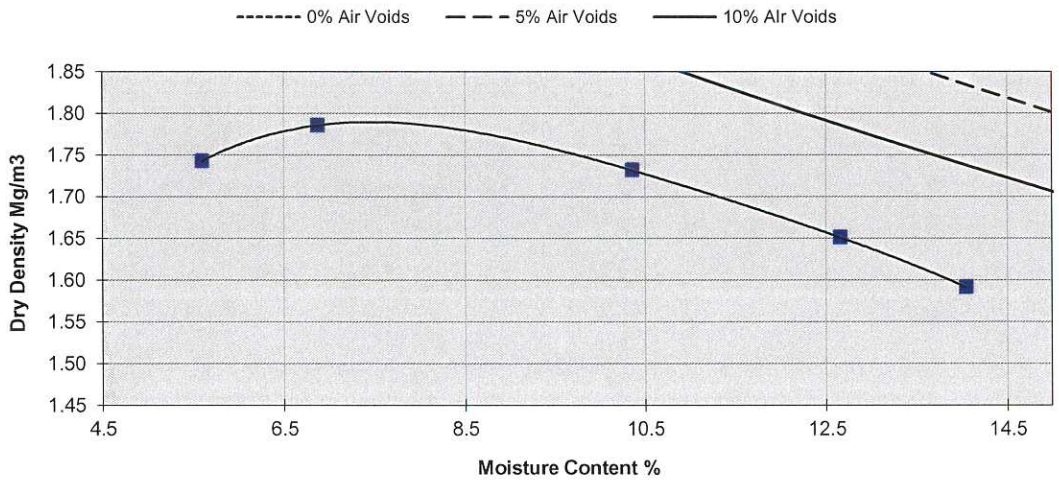
BS 1377:1990: Part 4

Job Number :	CGL7439-1	Date Tested :	04/08/2016
Client :	Wardell Armstrong	Date Reported :	05/08/2016
Client Reference :	ST15659	Sample UID :	76974
Project/Site :	Land of Adastral Park, Ipswich		

Client Sample Ref :	**Sample 1**	***Sample Type :***	Bulk
Supplier:		***Description :***	
Source:			Light Brown Sandy GRAVEL
Date sampled :	03/08/2016		
Sampling Cert. :	Yes		

Rammer used :	4.5 kg
No of sub samples :	5
Mould Size:	CBR

Bulk Density: Mg/m³	1.84	1.91	1.91	1.86	1.82
Moisture Content: %	5.6	6.9	10.4	12.7	14.0
Dry Density: Mg/m³	1.74	1.79	1.73	1.65	1.59



Maximum Dry Density (Mg/m³)	**1.79**
Optimum Moisture Content (%)	**7.5**

Dry Density/Moisture Content Relationship 4.5kg Rammer Tested in Accordance With BS 1377: Part 4: 1990

Particle Density Assumed at 2.65 Mg/m³

Authorised Signatory: **Mark Collyer**
Laboratory Manager

05/08/2016

Laboratory Testing Results

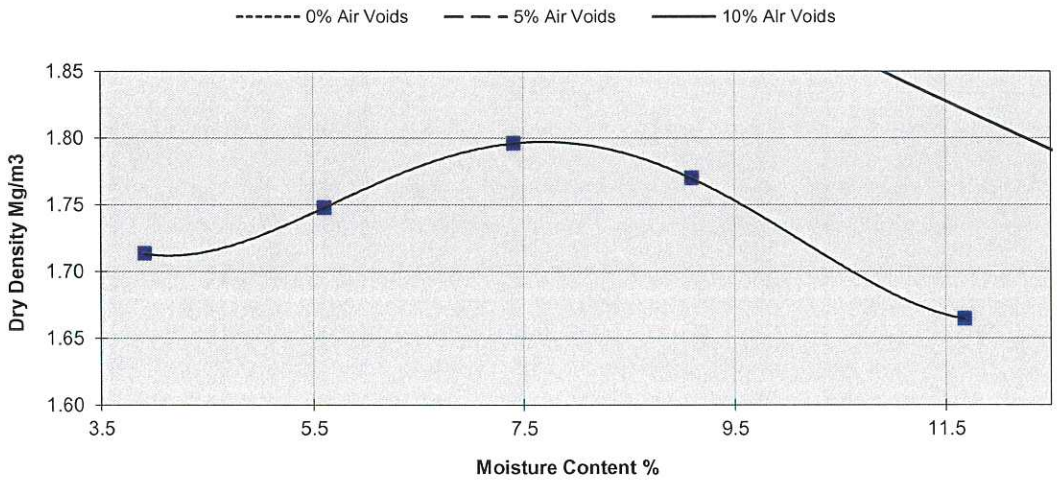
BS 1377:1990: Part 4

Job Number :	CGL7439-1	Date Tested :	04/08/2016
Client :	Wardell Armstrong	Date Reported :	05/08/2016
Client Reference :	ST15659	Sample UID :	76975
Project/Site :	Land of Adastral Park, Ipswich		

Client Sample Ref :	**Sample 1**	***Sample Type :***	Bulk
Supplier:		***Description :***	
Source:			Light Brown Sandy GRAVEL
Date sampled :	03/08/2016		
Sampling Cert. :	Yes		

Rammer used :	4.5 kg
No of sub samples :	5
Mould Size:	CBR

Bulk Density: Mg/m³	1.85	1.93	1.93	1.86	1.78
Moisture Content: %	5.6	7.4	9.1	11.7	3.9
Dry Density: Mg/m³	1.75	1.80	1.77	1.66	1.71



Maximum Dry Density (Mg/m³)	**1.80**
Optimum Moisture Content (%)	**7.6**

Dry Density/Moisture Content Relationship 4.5kg Rammer Tested in Accordance With BS 1377: Part 4: 1990

Particle Density Assumed at 2.65 Mg/m³

Authorised Signatory: **Mark Collyer**
Laboratory Manager

05/08/2016

QXXX
Rev0
07/16

PARTICLE SIZE DISTRIBUTION

BS 1377-2: 1990

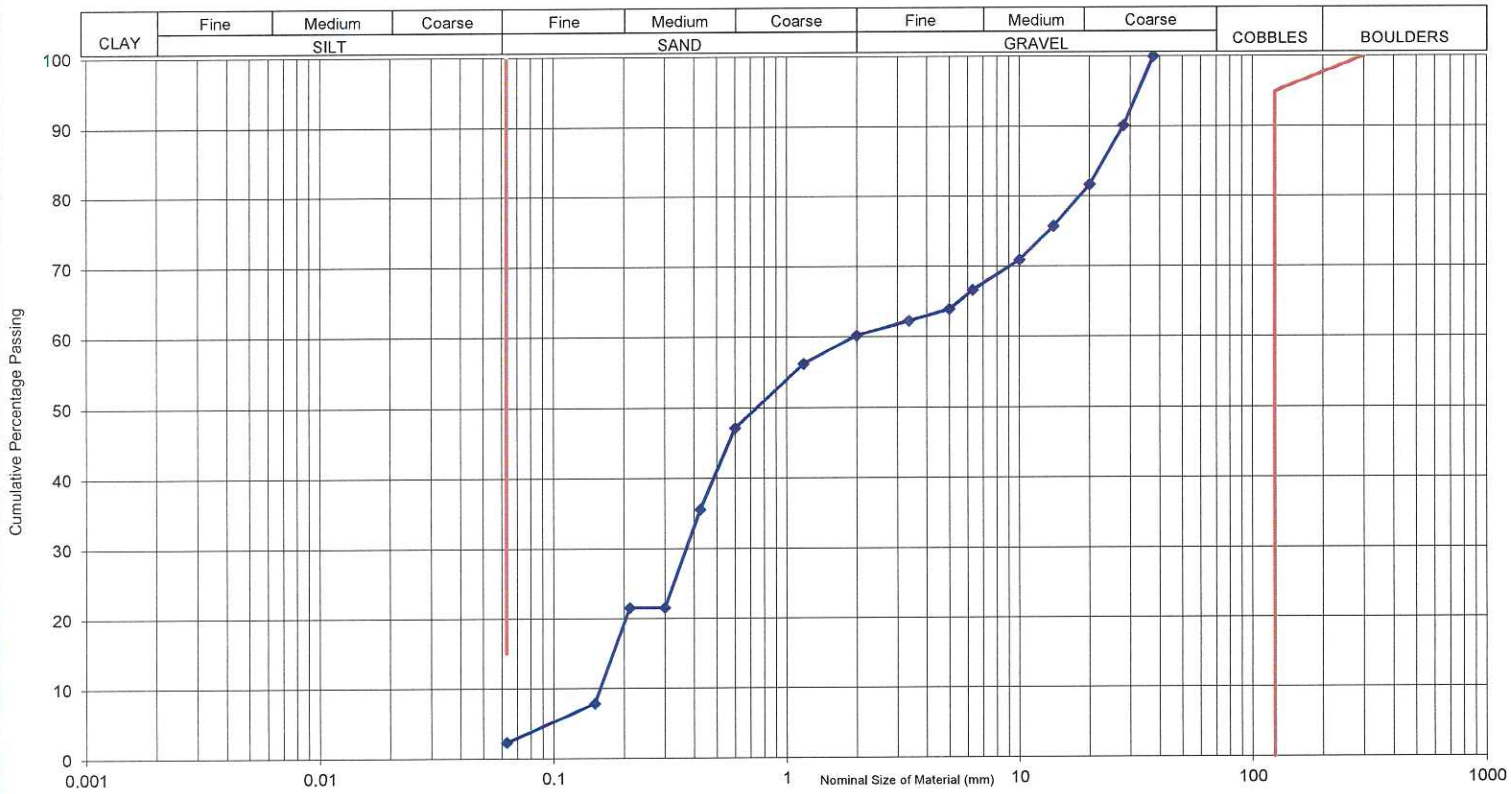
Chelmer Geotechnical Laboratories

Job Number : 7439-1
Sample Number : Sample 1
Depth (m) : -
Sample UID : 76974

Site Name : Land Of Adastral Park, Ipswich
Soil Description : Class 1A Light Brown Sandy Gravel
Location : Quarry Stockpile

Date Sampled : 03/08/2016

Type of Sieving : **Washed**
Date : 04-Aug-16
Tested By : WI
Laboratory : Chelmer Geotechnical CM3 8AB



Sieve Size (mm)	% Passing	Specification
300.0	100	100
125.0	100	95 - 100
90.0	100	
75.0	100	
63.0	100	
50.0	100	
37.5	100	
28.0	90	
20.0	82	
14.0	76	
10.0	71	
6.3	67	
5.0	64	
3.35	62	
2.0	60	
1.18	56	
0.600	47	
0.425	36	
0.300	22	
0.212	22	
0.150	8	
0.063	2.4	<15

UKAS TESTING 8284

Calculations :-

$$f = \frac{(M_1 - M_2) + P}{M_1} \times 100$$

$f = 100P/M_1$ (dry sieving)

f = Percentage of fines passing 63µm
M_1 = Mass of dried test sample before washing (kg)
M_2 = Mass of dried residue retained on the 63µm (kg)
P = Mass of screened material remaining in the pan (kg)

Comments :-

Coefficient of Uniformity = > 12 *Specification >10*

This sample complies with the grading requirements of SHW 600 Series Table 6/2 Class 1A

Sample taken by CGL & Client

Checked By :- SG

Date Checked :- 10-Aug-16

PARTICLE SIZE DISTRIBUTION

BS 1377-2: 1990

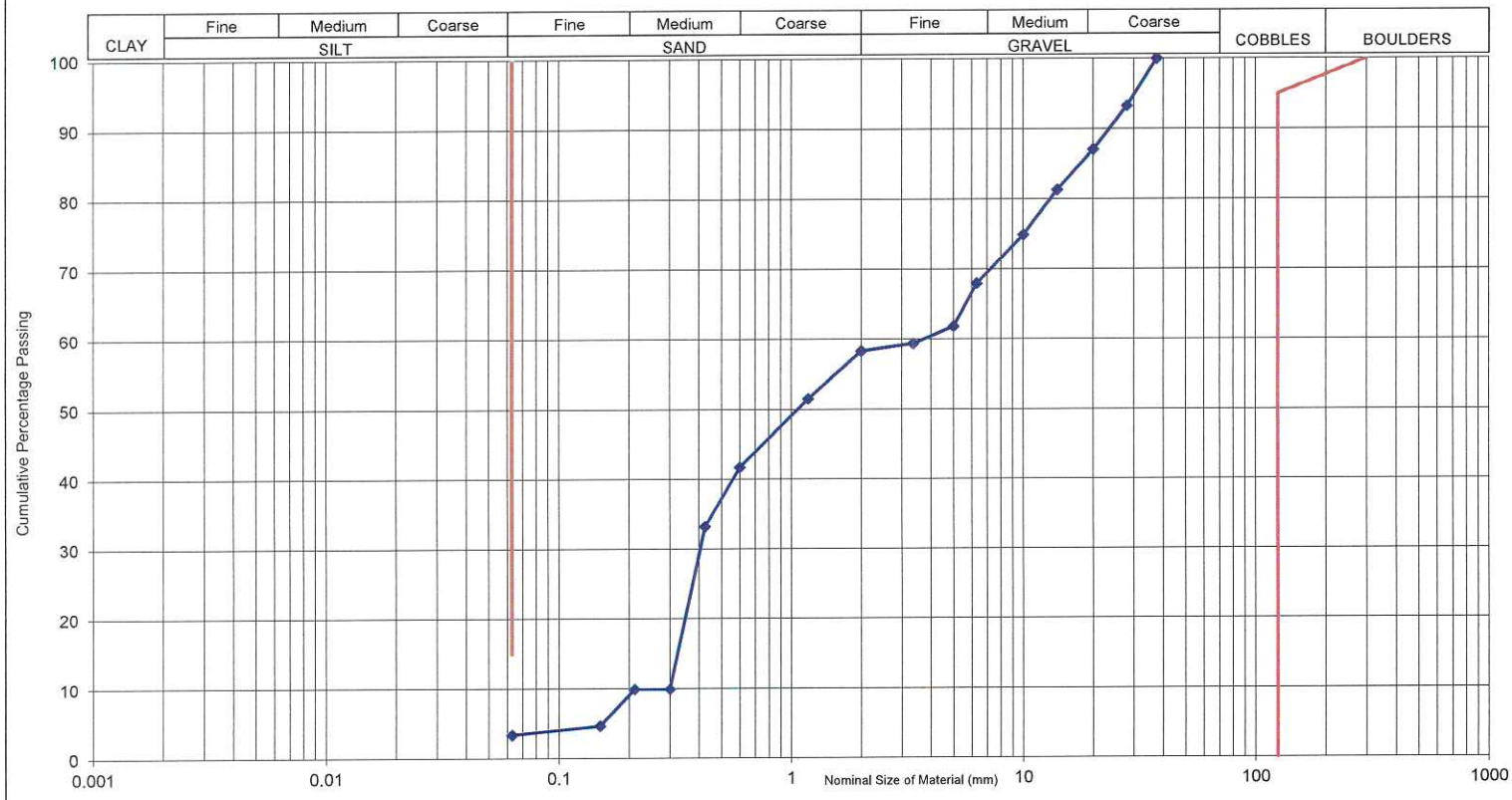
Chelmer Geotechnical Laboratories

Job Number : 7439-1
Sample Number : Sample 2
Depth (m) : -
Sample UID : 76975

Site Name : Land Of Adastral Park, Ipswich
Soil Description : Class 1A Light Brown Sandy Gravel
Location : Quarry Stockpile

Date Sampled : 03/08/2016

Type of Sieving : **Washed**
Date : 04-Aug-16
Tested By : WI
Laboratory : Chelmer Geotechnical CM3 8AB



Sieve Size (mm)	% Passing	Specification
300.0	100	100
125.0	100	95 - 100
90.0	100	
75.0	100	
63.0	100	
50.0	100	
37.5	100	
28.0	93	
20.0	87	
14.0	81	
10.0	75	
6.3	68	
5.0	62	
3.35	59	
2.0	58	
1.18	51	
0.600	42	
0.425	33	
0.300	10	
0.212	10	
0.150	5	
0.063	3.4	<15

UKAS TESTING
8284

Calculations :-

$$f = \frac{(M_1 - M_2) + P}{M_1} \times 100$$

$f = 100P/M_1$ (dry sieving)

f = Percentage of fines passing 63µm
M_1 = Mass of dried test sample before washing (kg)
M_2 = Mass of dried residue retained on the 63µm (kg)
P = Mass of screened material remaining in the pan (kg)

Comments :-

Coefficient of Uniformity = > 13 *Specification >10*

This sample complies with the grading requirements of SHW 600 Series Table 6/2 Class 1A

Sample taken by CGL & Client

Checked By :- SG

Date Checked :- 10-Aug-16

UKAS TESTING
8284

Chelmer
Geotechnical Laboratories

This report is personal to the client, confidential and non assignable. It is issued with no admission of liability to any third party.

This report shall not be reproduced, except in full, without the written approval of Chelmer Site Investigations Laboratories Ltd.

Where our involvement consists exclusively of testing samples, the results and comments (if provided) relate only to the samples tested.

Any samples that are deemed to be subject to deviation will be recorded as such within the test summary.

Appendix 3 – Geo Environmental Group Earthworks Specification – July 2016

GEG | Geo Environmental Group
Geotechnical, Environmental & Ecological Consultants

GEG House, 17 Graham Road, Malvern, WR14 2HR
Tel. 01684 212526 Fax 01684 576917 www.g-eg.co.uk

EARTHWORKS SPECIFICATION

ADASTRAL PARK
MARTLESHAM HEATH
IPSWICH
SUFFOLK
IP10 0BL

JULY 2016

Prepared for:

Brookbanks Consulting

COMMERCIAL ESTATES GROUP

Registered Company - GEG Ltd
Registered in England No 6469985
Registered Office: Granta Lodge, 71 Graham Rd, Malvern, WR14 2JS

REPORT TITLE: PRELIMINARY EARTHWORKS SPECIFICATION

Site Address:

Proposed Development
OS1, OS2 and R2 Areas
Adastral Park
Martlesham Heath
Ipswich
Suffolk
IP10 0BL

Performed By:
Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

On Behalf Of:
Commercial Estates Group
c/o Brookbanks Consulting Ltd
6150 Knights Court
Solihull Parkway
Birmingham
B37 7WY

Written by:

Matthew Perks
BSc(Hons) MSc FGS
Senior Engineer

Checked by:

Mark Rawlings
BSc(Hons) MSc FGS CGeol
Associate Director

Approved by:

Anthony Marriott
BSc(Hons) MRSC MIEnvSc FGS
Managing Director

Project Reference: GEG-16-458

Report Reference: GEG-16-458_EW_Spec

Issue Status: FINAL

Date: 18th July 2016

TABLE OF CONTENTS *PAGE*

Title ..... Appendix

FIGURES AND PLANS (CONTRACT DRAWINGS) .....A

Site Location Plan..... Figure 1
'Masterplan Phasing' Adastral Park, Ipswich.
'Ground Conditions Plan', WSP, Adastral Park, Ipswich, Figure 9.

1. INTRODUCTION

Geo Environmental Group (GEG) were commissioned by Brookbanks Consulting Ltd (Brookbanks) on behalf of their client Commercial Estates Group (CEG) to prepare a preliminary earthworks specification for the proposed Areas OS1, OS2 and R2 at the Adastral Park, Ipswich development.

1.1 The following information was provided by Brookbanks:

- *'Masterplan Phasing' Adastral Park, Ipswich.*
- *'Earthworks Strategy Report' undertaken by WSP for on behalf of BT Telereal in September 2009 which includes 'Ground Conditions Plan', WSP, Adastral Park, Ipswich, Figure 9.*

1.2 The preliminary Specification was required to provide guidance on the backfilling of a former sand quarry for proposed residential development with an associated provision of open space.

1.3 At this stage this preliminary specification cover 3 No. parcels of land as shown on the Masterplan phasing; 1 No. proposed for residential development which overs a total area of 9.7 ha (R1), and 2 No. for open space (OS1 and OS2) which cover total areas of 17.4 ha and 9.98 ha respectively.

1.4 According to the report undertaken by WSP in 2009 on the proposed earthworks, R1 and OS2 have been infilled with inert fill (in accordance with the current inert landfill licence to an unknown depth stated as 'deep landfill' in the northern 5.8 ha and 7.0 ha respectively [approx.]). The remainder of R1 contains open excavations at approximate depths of 8-9m (0.3 ha), 3-4m (1.9 ha), 11.3 to 15.8m (1.0 ha) and an area which was proposed 'to be worked' to 3-4m (0.7 ha). The remainder of OS2 contains open excavations at approximate depths of 3-4m (2.5 ha). OS1 contains open excavations at approximate depths of 8-9m (7.0 ha), 11.3 to 15.8m (7.0 ha) and 'to be worked' to 3-4m (3.4 ha).

1.5 The area coloured orange on the aforementioned WSP 'Ground Conditions Plan' in the areas of OS1, OS2 and R2 are currently awaiting ground investigations by GEG. At this stage there are no details of the nature of infilling material utilised to date on the site except that it conforms to an inert licence. In addition there are no details on the compaction techniques utilised as part in the infilling methodology or whether associated soft materials were identified and, if so, removed from the former pond areas. The required finished levels of the areas currently infilled and those to be infilled are currently unknown. However, it is assumed that the proposed residential development (R1) area will require infilling to the pre-excavation level, and the open space areas will require infilling, significantly in OS1, but there may be scope for reducing the finished levels to below the pre-excavation level in these areas.

2. DEFINITIONS

2.1 Definitions and Interpretation

Client *means the Commercial Estates Group.*

Engineer *means Geo Environmental Group.*

Contractor *means TBC.*

Client's Representative *means Brookbanks Consulting Ltd*

Works *means all the work necessary for the completion of the Contract including any variations required by the Engineer.*

Contract *means the Agreement, together with the Conditions of Contract, the Appendix and other items listed in the Contract Schedule including this Specification.*

Cost *means all expenditure properly incurred or to be incurred whether on or off the Site including overhead finance and other charges (including loss of interest) properly allocatable thereto but does not include any allowance for profit.*

Site *means the lands and other places on under in or through which the Works are to be undertaken and any other lands or places provided by the Employer for the purposes of the Contract together with such other places as may be designated in the Contract or subsequently agreed by the Engineer as forming part of the site.*

SHW *means the current Department of Transport Specification for Highway Works Series 600, Earthworks.*

Excepted Risks *are:-*

(a) The use or occupation by the Employer his agents servants or other contractors (not being employed by the Contractor) of any part of the Permanent Works.

(b) Any fault defect or omission in the design of the Works (other than a design provided by the Contractor pursuant to his obligations under the Contract).

(c) Riot war invasion act of foreign enemies or hostilities (whether war be declared or not).

(d) Civil war rebellion insurrection or military or usurped power.

(e) Ionizing radiations or contamination by radioactivity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component hereof.

(f) *Pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds.*

Made Ground or Fill *shall mean material which has not been naturally deposited but is regarded as inert. It includes gravel, sand, silt, clay, brick and concrete rubble. This could either be site won or imported. (Imported material will also require chemical compliance testing)*

Natural Ground *shall mean material that has been natural deposited. This could either be site won or imported material. (Imported material will also require chemical compliance testing at a lesser rate than Made Ground or Fill)*

Excavation Level *shall mean the level shown on the contract drawings to which it is proposed to excavate in both the fill and natural ground.*

Formation Level *shall mean the top level of the reinstated fills as shown on the Contract Drawings (i.e. finished ground level).*

Stockpile *shall be a temporary mound of excavated spoil no larger than 30,000m³ in volume.*

3. GENERAL INFORMATION

3.1 Conditions of Contract

3.1.1 The Conditions of Contract for the works shall be as specified by the Client, reverting to the current ICE Conditions of Contract for Highway Works where none are agreed.

3.2 Execution of Works

3.2.1 The whole of the Works shall be executed in the manner specified and in accordance with the descriptions and particulars shown in the Contract. Notwithstanding the above, works may be executed in an alternative manner put forward by the Contractor provided that prior agreement of the Engineer has been obtained in writing.

3.3 British Standards

3.3.1 All materials and workmanship used shall comply with the latest British Standards where applicable unless the description shall specifically deviate from these standards, and shall be fit for their intended use and shall be compatible with the other materials with which they are intended to function. Proprietary materials should be used strictly in accordance with the manufacturer's specification and requirements.

3.4 Materials

3.4.1 The requirements of this Clause refer to all materials to be used in the Works and are in addition to any specific requirements contained in the Specification. Documentary evidence shall be produced at the request of the Engineer that the materials and components to be included in the Works fully comply with the requirements of the Contract.

3.4.2 *If required by the Engineer the Contractor shall, as soon as possible after the Contract has been awarded and at least two weeks before delivery submit to the Engineer a list of the suppliers from whom he proposes to purchase the materials necessary for the execution of the works. Each supplier must be willing to admit the Engineer or his representative to his premises during ordinary working hours for the purpose of obtaining samples of the materials in question. Alternatively, if required by the Engineer, the Contractor shall deliver the samples of the materials to the Engineer's office; samples should be taken in accordance with the relevant British Standards where applicable. Materials subsequently supplied shall conform to the quality of samples that have been approved by the Engineer.*

3.4.3 *The information regarding the names of the suppliers may be submitted at different times as may be convenient but no sources of supply shall be changed without the Engineer's prior approval.*

3.4.4 *When any material or article is required to comply with the British Standard, the Contractor shall submit to the Engineer, test certificates furnished by the supplier or manufacturer of the material or article indicating compliance with the relevant British Standard.*

3.4.5 *The Contractor shall provide the Engineer with copies of the manufacturer's instructions for the handling and installation of their products.*

3.4.6 *The Engineer may periodically inspect and test materials used in the execution of the works. Should any material or goods be found not be comply with this Specification the Contractor shall remove them off site and replace such materials or goods from a manufacturer or supplier nominated by the Engineer without additional charge.*

3.5 Personnel and Relevant Experience

3.5.1 *Prior to commencement of the Works, the Contractor shall provide a list of key personnel he proposes to employ together with a resume of their experience and qualification. The list of key personnel shall include the name of the full time Contractor's Agent or representative who shall fulfil those duties as defined in of the Conditions of Contract.*

3.6 Setting Out

3.6.1 *Before commencement of the Works, the Contractor will be supplied with the information to establish the lines and levels of the Works.*

3.7 Records of the Works

3.7.1 *The following records shall be made on sheets with an agreed layout. Two copies of each record signed by the Contractor shall be delivered to the Engineer's office by the following stated times:*

i. *Labour, plant and equipment. (Weekly by noon of the following Monday)*
ii. *Progress report and monitoring results (Weekly by noon of the following Monday).*

3.8 Record Frequency Time for Delivery

3.8.1 *Results of all records, tests, instrument measurements and calibrations made during the Contract shall be supplied to the Engineer at times or intervals to be agreed unless specified.*

3.8.2 *A daily record shall be kept of the maximum and minimum outside shade temperatures, and rainfall at site. One copy of the record shall be provided to the Engineer weekly.*

3.9 Tests and Testing Facilities

3.9.1 *All tests required by the Engineer as per the Specification shall be carried out by the Contractor. One copy of the test results shall be supplied direct to the Engineer within 5 days of the sample being taken.*

3.9.2 *Before the Work begins on Site, a list of quality control tests, the facilities and equipment to be used and the names of independent testing laboratories for these and all other tests called for by the Specification shall be submitted to the Engineer.*

3.9.3 *All testing equipment shall be calibrated and re-calibrated at regular intervals by a UKAS accredited organisation and calibration certificates shall be provided upon request.*

3.10 Reinstatement

3.10.1 *Unless otherwise directed by the Engineer, the Contractor shall permanently reinstate all areas disturbed by the Works, including surfaces, walls, fences, grassed areas etc., to a condition equivalent to that existing before the commencement of the Works and shall provide all materials required. All such reinstatement shall be to the approval and satisfaction of the Engineer and the Authorities, Owners and Occupiers concerned.*

3.10.2 *The finished ground level of the Site shall be to the proposal levels as outlined in the Contract Drawings. The Contractor shall be responsible for maintaining the reinstatement, and making good the surface of trenches / boreholes, all sinkages, scouring, erosion or other defects.*

3.11 Protection of Properties and Utilities

3.11.1 *Precautions shall be taken to prevent damage to properties, utilities and surface structures (including existing roads), either fixed or otherwise, on or adjacent to the Site, in or through which the Works and Works activities will be executed, and indemnify the Employer against all claims in connection therewith. Damage shall be promptly made good where appropriate and third party claims shall be promptly met by the Contractor. Any requirement for road cleaning resulting from the Works and / or Works activities shall be borne solely by the Contractor.*

3.11.2 *All such damage and claims for damage shall be recorded and reported to the Engineer. In the case of damage to private properties, the Engineer shall be immediately informed whatever the circumstances.*

3.12 Removal of Existing Vegetation and Trees

3.12.1 Prior to carrying out works which could affect existing trees, hedges or bushes within or adjacent to the Site the Contractor shall obtain the Engineer's approval. Any unauthorised damage shall be rectified by a registered tree surgeon or by replacement with a tree of equivalent species and size at the Contractor's expense. All work which will affect existing trees, hedges or bushes is to be conducted between November and February, and with the approval of the Engineer.

3.13 The Site

3.13.1 The Contractor shall confine his operations to within the Site boundary. The Contractor shall at all times keep the Site clean and tidy. The Contractor shall be responsible for the disposal of all mud, water, chippings, soil or other waste products resulting directly or indirectly from the Works. Upon instructions from the Engineer, when the Works have been satisfactorily completed, the Contractor shall leave the Site in a clean and tidy condition. The Site boundary and additional available working area is defined on the Contract Drawings.

3.14 Contractor's Facilities

3.14.1 The Contractor shall provide all the facilities he requires to perform the Works in compliance with all statutory requirements and good practice. The Contractor shall be deemed to have included in his costing for the provision of electricity, sewerage, water, gas and any data / phone lines required as well as maintenance and removal of these facilities.

3.15 Site Water Supply

3.15.1 The Contractor shall be responsible for locating a suitable water supply and for providing and paying for all temporary plumbing and connection of the water supply to Site. Where a suitable water supply is not available, the Contractor shall make arrangements for carrying and storing water in quantities as necessary for the Works. All costs incurred in this respect shall be borne by the Contractor. The Contractor is responsible for the sensible use of water and for the care and the maintenance of the pipe work from the supply point.

3.16 Site Electricity Supply

3.16.1 The Contractor shall be responsible for locating a suitable electrical supply and for providing and paying for all temporary connections of the electricity supply to Site. Where a suitable electricity supply is not available, the Contractor shall make arrangements for mobile electricity generating plant in quantities as necessary for the Works. All costs incurred in this respect shall be borne by the Contractor. The Contractor is responsible for the sensible use of electricity and for the care and the maintenance of the cable work from the supply point.

3.17 Provision of Services

3.17.1 The Contractor shall be responsible for providing for his own use any additional services on the Site. The Contractor shall also be responsible for any diversion or alterations to existing services which he requires. All costs incurred shall be borne by the Contractor.

3.17.2 The Contractor shall be responsible for obtaining all relevant abstraction and discharge consents to suit his method of working. All costs incurred shall be borne by the Contractor.

3.18 Pollution Prevention

3.18.1 All works shall be carried out in accordance with current DEFRA guidance relating to pollution prevention.

3.19 Site Waste Management (Preliminary)

3.19.1 The Contractor shall ensure that the adopted approved Waste Management Scheme for the site development is adhered to. This may include the provision of a Waste Management Exemption (envisaged to be U1 – use of waste in construction) from the Environment Agency for the proposed fill materials in the proposed residential area and the provision of a Waste Management Licence for inert filling of the Open Space Areas.

3.19.2 A site waste management plan shall be prepared by the Contractor to detail how he proposes to deal with, treat, audit and quantify etc. types of waste in line with current legislation and Environment Agency guidance.

3.20 Storage of Hazardous Materials

3.20.1 In compliance with COSHH legislation, the Contractor shall make arrangements for the safe storage of hazardous materials that he may require to use in connection with the Works and for their distribution about the Site.

3.20.2 If any areas of the Site become contaminated with imported hazardous materials they shall be treated at the Contractor's expense and to the satisfaction of the Engineer.

3.21 Hours of Working

3.21.1 The hours of working on the Site shall be from 08:00 to 18:00 from Monday to Friday and 8:30 to 13:00 on Saturdays. Maintenance work may be permitted outside these hours with the prior written permission of the Engineer.

3.20.2 Under no circumstances shall work on the Site be carried out outside the specified hours or at any time on Sunday or Public Holidays without the written permission of the Engineer.

3.22 Work Outside the Hours of Daylight

3.21.1 When the Contractor elects to work outside the hours of daylight, he shall be responsible for providing adequate lighting to ensure quality of the work and safe working conditions, and shall satisfy himself that such methods of working will not inconvenience other parties or create a nuisance. Such lighting shall include illumination of the compound areas from dusk to completion of work each day.

3.23 Complaints from the Public

3.22.1 The Contractor shall instruct his staff to respond courteously to any complaints from the public and report these immediately to the Contractor's Site Agent and the Engineer.

3.22.2 The Contractor shall keep a log of all such complaints together with a record of action taken. The Contractor shall immediately rectify any matter giving reasonable grounds for complaints which lie within his jurisdiction. All other matters of complaint shall be immediately reported to the Engineer.

3.24 Advertising and Sign Boards

3.23.1 No sign boards shall be erected by the Contractor for advertisement purposes without prior written approval of the Engineer and the Employer. Nevertheless, the Contractor shall prominently display a sign providing permanently-available emergency contact details for use by the general public in the event of an emergency occurring on the Site outside normal working hours.

3.25 Noise Control and Nuisance

3.24.1 The Contractor shall during the course of the Contract take every precaution to prevent nuisance in the form of noise, dust, odour and water from occurring. In organising the operations to be carried out within the Site, the Contractor shall take into consideration the nuisance effect of his proposals and employ any economically viable means to reduce such effects as necessary.

3.24.2 The Contractor shall employ the best practical means to minimise noise vibration produced by his operations and shall have regard to the recommendations in BS 5228-1:1997, Noise and Vibration Control on Construction and Open Sites.

3.24.2 The Contractor shall include within the Activity Schedule / Programme details of how noise, dust, odour and water will be monitored, how potential nuisance will be assessed and what potential mitigation measures will be employed.

3.26 Health & Safety

3.25.1 The Contractor's attention is drawn to all appropriate Health and Safety legislation, guidance and advice including:

- *The Health and Safety at Work etc. Act 1974 (HASAWA).*
- *The Management of Health and Safety at Work Regulations 1999 (MHSR Regs.).*
- *The Control of Substances Hazardous to Health Regulations 2002 (COSHH Regs.).*
- *The Construction (Design and Management) Regulations 2015 (CDM).*
- *The Control of Noise at Work Regulations 2005.*

3.25.2 The Contractor's attention is drawn to the Pre Construction Health and Safety Information that will be supplied by the Client.

3.25.3 The Contractor shall agree with the Engineer a photographic record of the areas affected by his Works before commencing work on the Site.

3.25.4 The Contractor shall agree with the Engineer the arrangements for plant location, parking etc. before commencing work on the Site.

3.27 Licences and Permits

3.26.1 The Contractor shall obtain all relevant licences and permits, from the relevant authorities, to carry out the Works.

3.26.2 All costs shall be borne by the Contractor.

3.28 Site Security

3.27.1 It shall be the responsibility of the Contractor to ensure that the Site is secure throughout the Works and that no access to the public is available. The Contractor shall provide security at the Site for the duration of the Works.

4. EARTHWORKS

4.1 Earthworks Volumes

4.1.1 Cut & fill volumes require confirmation by the Client's Representative, prior to commencement of the works in order to derive excess cut/fill volumes. Significant areas of fill are anticipated on the site which have been quarried to depths of approximately 8m to 9m bgl and locally to approximately 11m to 16m bgl. The adjacent northern and southern sections of the area, however, have had significant landfilling. Further site investigation by the Engineer is proposed shortly in order to target the deep filled and deep extraction areas of the site.

4.1.2 The estimated volume of any remaining topsoil to be stripped prior to the earthworks operation will be confirmed by Brookbanks Consulting, the Client's Representative.

4.1.3 Excess materials should be stockpiled in accordance with the SHW at suitable locations as agreed with the Engineer. The solid geology directly beneath the majority of the site comprises Red Crag Formation (sand). The southern and central areas of R2 and OS2 appear to be overlain by superficial deposits of Kesgrave Formation (Sand & Gravel). According to a geological cross section from BGS (referenced in the report by WSP dated September 2009 on the entire Adastral Park site) the Kesgrave Formation (where present) and the Red Crag Formation both exist to thicknesses of 5-10m and the Red Crag Formation overlies the London Clay which is approximately 10m thick. It is likely that much of the Kesgrave and Red Crag Formation have been extracted as part of the quarrying works. All stockpiles should be suitably bladed / graded with an excavator to prevent water ingress.

4.2 Material Classification

4.2.1 *The source of the soils to be used as fill materials on the site requires confirmation.*

4.2.2 *The Contractor should make their own assessment of the earthwork materials, classify the proposed fill and determine the appropriate Method of Compaction in accordance with the SHW. The Contractor shall undertake a number of trial pits to confirm earthworks materials, recover soil samples, undertake geotechnical laboratory testing and classify the materials in accordance with the SHW Tables 6/1 and 6/4.*

4.2.3 *The Contractor shall submit to the Engineer for approval, the results of the confirmatory trial pits, geotechnical laboratory testing, materials classification and proposed Method of Compaction (in accordance with the SHW) at least 5 working days prior to the proposed commencement of filling operations.*

4.3 General Specification (Backfilling and Compaction)

4.3.1 *All earthworks shall be completed by the Contractor in a controlled manner using only approved fill materials.*

4.3.2 *Filling operations and compaction shall be carried in such a manner as to achieve the finished Site levels. All earthworks materials shall meet the requirements of the Specification. Testing is to be undertaken by the Contractor to confirm the suitability of the materials for use on the site, with results provided to the Engineer.*

4.3.3 *Filling operations and compaction of all materials, including topsoil and subsoil, will be carried out generally in accordance with the SHW.*

4.3.4 *Compacted backfilled material is to achieve a minimum of 95% of maximum dry density, based on a 4.5kg rammer test BS1377 part 4 for the proposed residential areas. A minimum bearing capacity of 100 kN/m² with a maximum settlement of 10mm is required for the proposed residential areas, which will be verified by plate load tests. The specification for the plate bearing tests will be in accordance with BS 1377: Part 9 (600mm plate diameter) and test results shall include a plot of bearing pressure (in kN/m² against settlement in mm); the frequency of testing shall be in accordance with Section 4.12 and* ***the exact locations to be agreed with the Engineer****).*

4.3.5 *Particular reference will be made to:*

- *Classification of materials according to their physical and engineering properties including examination of the field characteristics of the materials and the carrying out of laboratory tests in accordance with the British Standard BS 1377:1990, in order that the materials can be placed into one or more of the categories identified in SHW Table 6/1.*
- *Types and methods of operator of compaction plant to be used, the condition of the plant provided, the appropriate layer thickness and the number of passes required to meet the stipulated objectives as outlined in SHW Table 6/4.*

- *Control of water and Site activities such that damage to compacted materials is avoided.*

4.4 Particular Specification

4.4.1 The following requirements are incorporated to supplement this Specification:

4.4.2 Prior to commencement of compaction works, field trials shall be undertaken by the Contractor with the plant proposed for the compaction operations and sampling and testing of the earthworks materials will be carried out by the Contractor to establish the required degree of application for the compaction plant approved by the Engineer.

4.4.3 SHW Tables 6/1 and 6/4 should be used by the Contractor to determine acceptable methods of compaction for materials to be placed on the Site based in order to achieve the particular requirements of this Performance Specification.

4.4.4 The results of the field trials and laboratory testing will be used by the Contractor to determine the acceptable limits for the suitability of the fill materials and these results shall be provided to the Engineer for checking and approval. Suitable material shall be defined as imported or excavated material that meets the following criteria:

- *The moisture content of the material shall be such that the material is capable of achieving a minimum of 95% maximum dry density as determined by BS1377 Part 4 (4.5kg rammer) for the proposed residential areas.*
- *For cohesive soils the liquid limit shall not be in excess of 90 or the plasticity index does not exceed 65.*
- *The materials shall be capable of achieving 95% of their maximum dry density when compacted, for the proposed residential areas, as defined by the Site compaction trials / laboratory tests);*
- *The materials shall not contain wood, peat, putrescible materials, slag (as a by-product of steel production) or scrap metal;*
- *The materials shall not be frozen or waterlogged;*
- *The size or shape of particles shall be appropriate to ensure that proper compaction is possible*
- *The materials shall have a calorific value less than 7MJ/kg.*

4.4.5 Should the source or the nature of the fill material change significantly for whatever reason, further compaction trials and laboratory testing will be required to establish new compaction parameters.

4.4.6 No filling and compaction within the permanent Works shall be carried out until the results of the laboratory and field trials are known.

4.4.7 The Engineer's approval of all areas of prepared formation shall be obtained by the Contractor prior to the commencement of any filling operations. All areas of the Site shall be surveyed and levelled by the Contractor before any material is deposited and at the final completion of compaction works.

4.4.8 The Contractor shall so arrange his work as to allow the Engineer the opportunity to carry out such surveys/geotechnical testing himself or to check any survey performed by the Contractor.

4.4.9 Before the placing of any fill, the Engineer may require that the formation / natural ground shall be compacted by the number of passes of the compaction plant appropriate to the classification of the natural ground, assuming a layer 125mm in thickness. If required any soft or unsuitable material shall be removed by the Contractor to a depth specified by the Engineer, prior to any filling.

4.4.10 Where possible all fill shall be spread in uniform horizontal layers of the requisite thickness and shall be compacted as soon as possible after deposition by approved compaction plant. Earthmoving equipment shall not be accepted as suitable compaction plant but where possible it shall be routed across the Site to give a uniform compactive effort.

4.4.11 Any necessary adjustments to the natural moisture content of the material to be compacted will be made in order to comply with the requirement of the SHW. The necessary adjustments shall be made by either water sprinkling and/or materials selection and mixing techniques prior to compaction.

4.4.12 Special care shall be taken around the margin of the fill to ensure that these areas are properly compacted. If necessary, special compaction machinery shall be used but in no case will a lower standard of compaction be accepted.

4.4.13 Each area of compacted backfill shall be properly integrated with adjacent or previously backfilled areas. The weathered, loose or partially compacted material accumulated on the side slopes of such areas shall be removed and replaced with suitably layered and compacted materials.

4.4.14 The side slopes of the compacted backfill materials shall be maintained in a stable condition by compliance with the maximum slope angles and the provision of benches at appropriate intervals.

4.4.15 Where any materials are encountered which cannot be accommodated with the backfilling operations, the Engineer may require such materials be broken down to an acceptable size prior to emplacement, or placed in an area of the Works designated for unsuitable materials.

4.4.16 No unsuitable material exceeding 0.015m³ in volume shall be placed within 2.0 metres of the final surface of backfilling.

4.5 Compaction Monitoring

4.5.1 ***The Contractor is to undertake testing at the locations agreed by the Engineer****. The monitoring will involve field measurement of the density and moisture content of the fill materials using an approved nuclear density/moisture test gauge. The results so obtained in the field will be monitored as necessary by sand replacement tests, moisture content determination, laboratory compaction tests and other laboratory tests carried out in accordance with British Standards. Other testing may be required following confirmation of the proposed fill.*

4.5.2 The Engineer shall undertake independent in-situ geotechnical tests to ensure the material is compacted in accordance with the Specification. The test results shall be provided to the Contractor on a weekly basis. Should the material in the test locations prove not to conform with the requirements of the Specification, the Contractor shall remove the material in that area and re-compact to conform with the requirements of the Specification.

4.6 Loose Materials

4.6.1 Where excavations are carried out for the formation of cut slopes; the surface of such slopes shall be cleared of all rock fragments or other loose material. If in the opinion of the Engineer a slope surface will not withstand the effect of weather the Contractor shall excavate any insecure material to the approved depth and build up the resulting cavity with such material as the Engineer directs.

4.7 Temporary Storage

4.7.1 Temporary storage of excavated materials required for re-use in the Works will be permitted on Site to such volumes and heights as approved by the planning Authority and the Engineer. Where storage of materials on Site is not possible the Contractor shall remove the whole of any part of such material to store off Site and subsequently return it to the Site for use in the Works. The location of any temporary storage shall be approved by the Engineer in advance.

4.8 Temporary Drainage

4.8.1 An adequate fall shall be maintained on the compacted fill surface at all times so that surface water may be shed rapidly. If any ponding or surface erosion shall occur, the Contractor shall, at his own expense, immediately take steps to remedy the situation.

4.9 Weather Conditions

4.9.1 Tipping, spreading and compacting shall cease when conditions are such that the mechanical plant which is either tipping spreading or compacting shall, in the opinion of the Engineer, start to damage the already deposited and compacted material and cause the surface to deteriorate. These operations shall only re-commence by agreement with the Engineer. In the event of the work being suspended by prolonged wet weather or frost, filling operations shall not be resumed until the surface has drained or thawed and inspections have shown it still to be in a satisfactory state of compaction. If considered necessary, re-excavation and/or further compaction shall take place to restore the surface to its previous condition before any new fill is deposited.

4.10 Regrading and Levelling

4.10.1 The Engineer may direct that certain areas be subject to final re-grading and levelling, such as in areas which, due to prevailing site traffic, have been affected by the concentrated passage of site vehicles etc.

4.11 Records

4.11.1 The Contractor shall record, and present to the Engineer each week, the following (which shall be monitored on a daily basis):

- *Quantity of each type of material excavated and deposited;*
- *Layer thicknesses;*
- *Compaction plant used;*
- *Number of passes for each type of material;*
- *Obstructions;*
- *Delays;*
- *Weather conditions; and*
- *Plant and personnel on Site.*

4.12 Testing Frequency

4.12.1 In addition to the routine testing of materials using the Nuclear Test Gauge (NTG), the following in-situ and laboratory testing of the compacted earthworks materials will be required ***at locations agreed with the Engineer for the proposed residential and public open space areas****:*

Proposed Residential Area:

- *Moisture Content / NDG test 1 test/500m³/material*
- *Atterberg Limits & Moisture Content (cohesive fill only) 1 test/1000m³/material.*
- *Specific Gravity 1 test/1,000m³/material*
- *Moisture/Density Relationship (4.5kg) 1 test/1,000m³/material*
- *Sand Replacement Test 1 test/1,000m³/material*
- *Particle Size Distribution 1 test/1,000m³/material*
- *Plate Bearing Tests at an average of 1 test per 2,000m² of finished development at 1.00m vertical intervals of filling (with a minimum of 1 test per filled layer)*

Where materials are unsuitable for NDG, these tests shall be replaced with the Sand Replacement Test up to a maximum of 1 test/500m³/material

Proposed Open Space Area:

- *25 No Moisture Content / NDG test 1 test.*
- *25 No. Atterberg Limits & Moisture Content (cohesive fill only)*
- *25 No. Specific Gravity*
- *25 No. Moisture/Density Relationship (4.5kg)*
- *25 No. Sand Replacement Test*
- *25 No. Particle Size Distribution*
- *25 No. Plate Bearing Tests of finished development at 1.00m vertical intervals of filling*

Where materials are unsuitable for NDG, these tests shall be replaced with the Sand Replacement Test.

4.13 Attendance at meetings

4.13.1 The Contractor will be required to attend a variety of meetings in order to successfully complete the Contract. It is likely that the required meetings will include attendance at:

- *Monthly progress meetings to be held on Site with the Project Team by the Contractor's Engineer and site manager;*
- *Weekly meetings with the Engineer by the Contractor's site manager;*
- *Daily Liaison with the Engineer on site by the Contractor's site manager;*
- *Ad Hoc meetings as necessary.*

4.14 Production of Verification Report

4.14.1 Upon completion of the project the Contractor is to compile all relevant site data and produce a Verification report for all of the works undertaken during the course of the Contract. As a minimum the completion report is to include:

- *As Built Surveys and Drawings*
- *Final Excavation and Fill Volumes*
- *Photographic record*
- *Records of all validation testing including laboratory certificates*
- *Records of all geotechnical testing including laboratory certificates*
- *Records of all imported material including Duty of Care confirmation*
- *Records of materials taken off site including Duty of Care confirmation*
- *Records of environmental monitoring*
- *Records of weather measurements*

SITE LOCATION

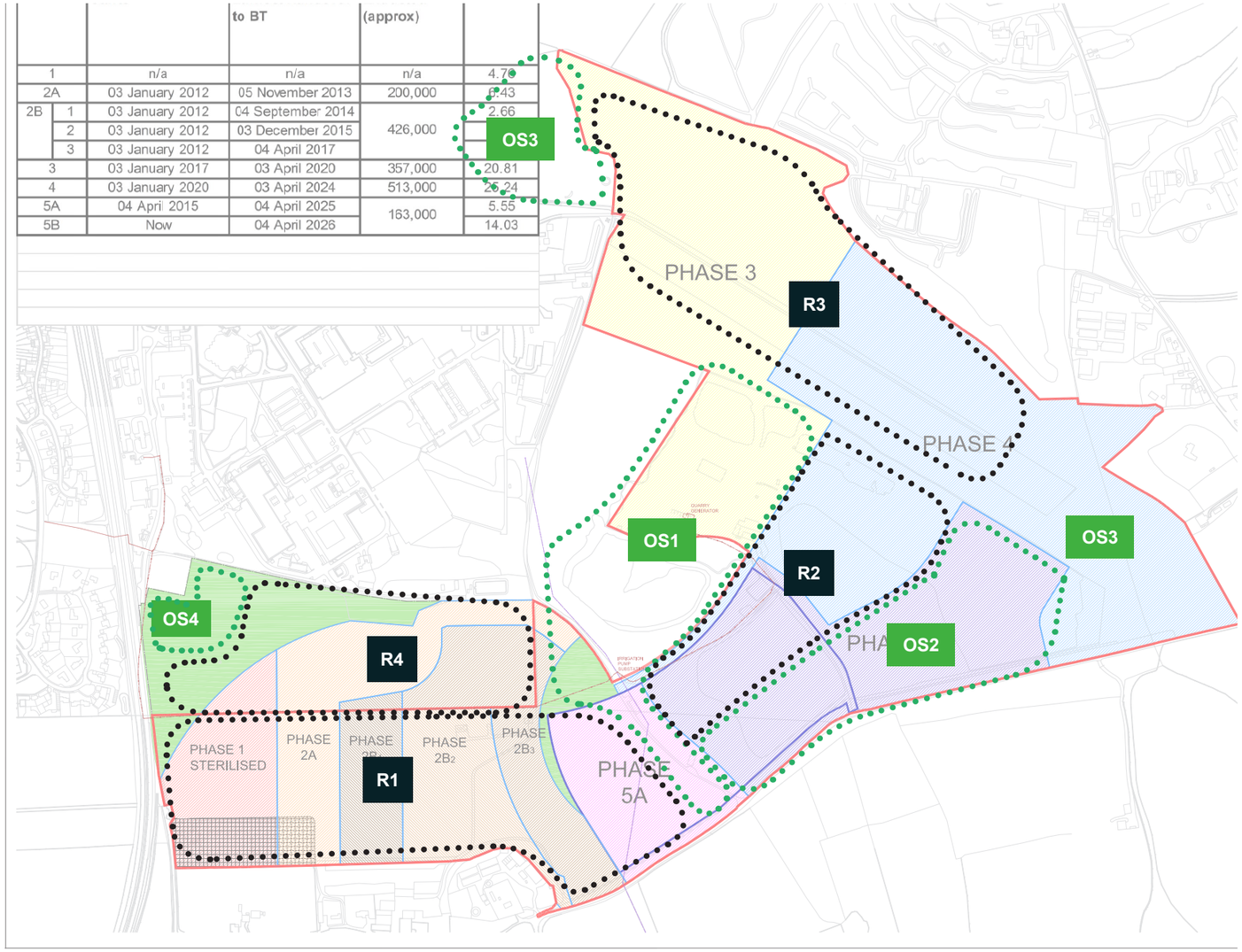
TITLE: FIGURE 1 : SITE LOCATION PLAN	
SITE: ADASTRAL PARK, IPSWICH	
CLIENT: BROOKBANKS CONSULTING / COMMERCIAL ESTATES GROUP	
PROJECT No.: GEG-16-458	**DRAWN/CHECKED:** MP / AM
SCALE: NTS	**DATE:** 12/07/16

Geo Environmental Group

GEG House
17 Graham Road
Malvern, WR14 2HR
Tel. 01684 212526
Fax 01684 576917
admin@g-eg.co.uk
www.g-eg.co.uk

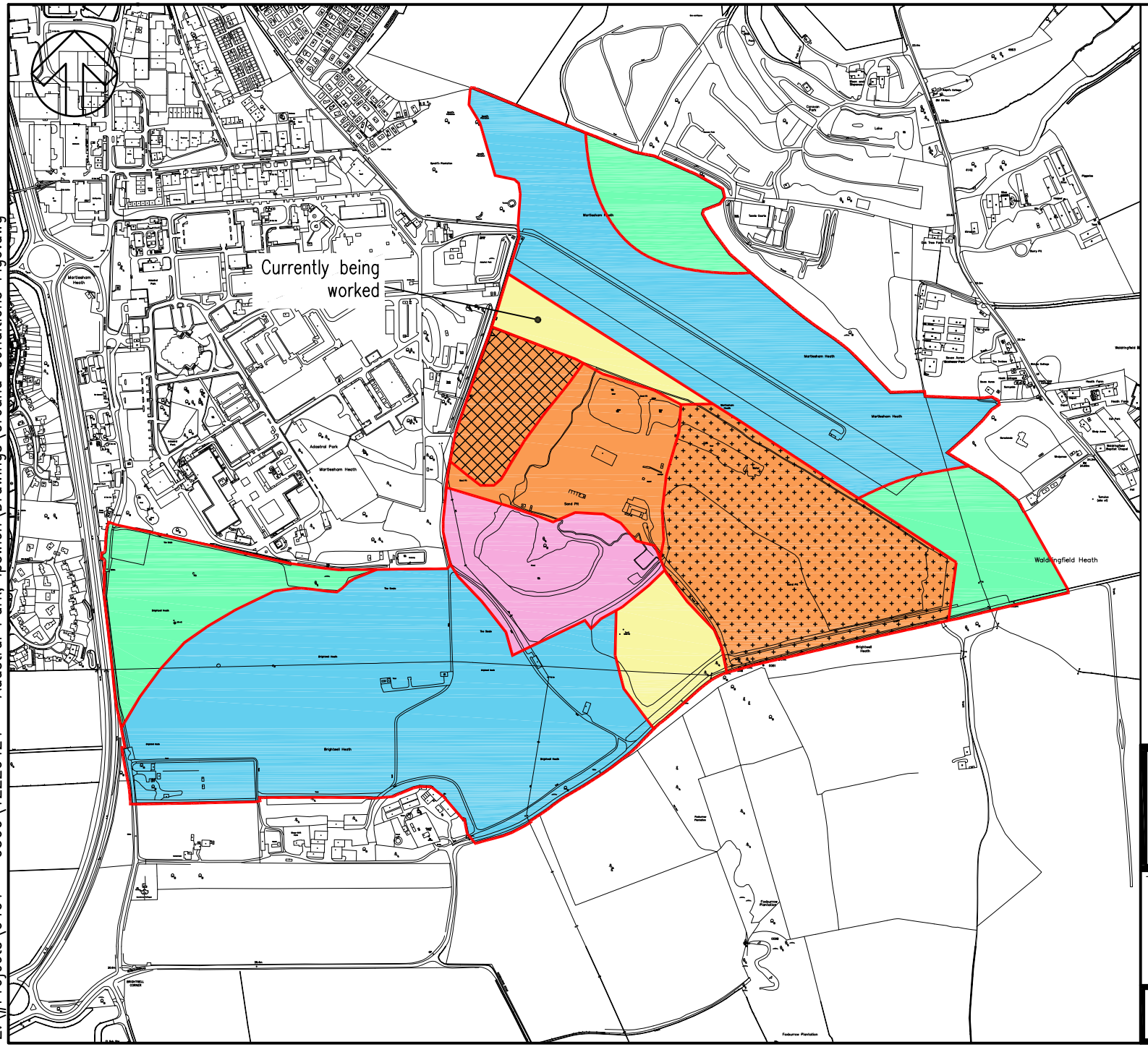
Masterplan phasing

		to BT	(approx)	
1	n/a	n/a	n/a	4.70
2A	03 January 2012	05 November 2013	200,000	9.43
2B 1	03 January 2012	04 September 2014	426,000	2.66
2	03 January 2012	03 December 2015		
3	03 January 2012	04 April 2017		
3	03 January 2017	03 April 2020	357,000	20.81
4	03 January 2020	03 April 2024	513,000	26.24
5A	04 April 2015	04 April 2025	163,000	5.55
5B	Now	04 April 2026		14.03



Approximate phasing delivery calculations

Parcel	Density (dph)	Area (ha)	Dwellings	Open space provision (ha)	Approximate Years**	Average unit delivery per year
1	35	17.23	603	17.40	1 to 3	201
2	35	9.7	340	9.98	4 to 6	113
3	35	17.1	599	16.15	7 to 10	150
4	35	9.6	336	3.43	11 to 12	168
Totals			**1877**	**46.96**		



Key

Quarrying Activities

- Worked to depths below water table (11.3–15.8m bgl)
- Worked to depths 8–9m bgl
- Worked to depths 3–4m bgl
- To be worked to depths 3–4m bgl
- Not to be worked

Landfilling Activities

- Deep historic landfill before current inert licence
- Deep landfill deposited in accordance to current inert licence.

WSP

TITLE:

Adastral Park, Ipswich

Ground Conditions Plan

FIGURE No:

Figure 9

Z:\#Projects\0401 – 0500\12220424 – Adastral Park, Ipswich\Drawings\Ground Conditions Fig9.dwg

CARLYLE LAND
LIMITED

ceg:

Andrew McCloy
Recreation Consultant

bakerconsultants

BroadwayMalyan BM

Brookbanks

CODE Development Planners

EFM

MONTAGU EVANS

orion.

pioneer
housing & development consultants

RSK

SES
SOUTHERN ECOLOGICAL SOLUTIONS

TG Tyler Grange

Land south and east of Adastral Park