

**APPENDIX 8.4**  
**GEO INVESTIGATION &**  
**ASSESSMENT**



## Project Lightning

Geo-environmental Investigation and Assessment

24 November 2014



## Quality Management

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# 1. Summary

## 1.1 Context

- 1.1.1 Capita Property and Infrastructure Limited was appointed by SEGRO plc (the Client) to undertake a Geo-environmental Investigation and Assessment of the Nestlé UK Ltd premises at North Hyde Gardens in Hayes, Middlesex. These premises are approximately centred on post code UB3 4RF and at Ordnance Survey National Grid Reference 510100, 179190.
- 1.1.2 At the time of reporting (November 2014) the subject site comprised an operational Nestlé factory covering circa 12 hectares used for the manufacturing of instant coffee and previously also for chocolate production. It is understood that the factory will close at the end of 2014, following which the site may be sold for redevelopment. SEGRO is considering acquiring the site for a mixed use scheme comprising both commercial properties and housing, potentially including multi-storey residential blocks.

## 1.2 Ground Investigation

- 1.2.1 A ground investigation was carried out at the site by Capita in October and November 2014 comprising 13 boreholes up to 6m deep plus associated laboratory analysis of soil and groundwater samples and water / ground gas monitoring. This followed a 2013 desk study, a 2013/14 Phase 2 investigation (comprising 9 boreholes and 34 window samples) and a 2014 Subsurface Asbestos Investigation by Geosyntec Ltd, undertaken on behalf of Nestlé. The associated Geosyntec reports were made available to Capita and were used to inform our assessment.
- 1.2.2 The encountered stratigraphy typically comprised concrete surfacing (or localised macadam or topsoil) over Made Ground, discontinuous Brickearth, Lynch Hill Gravel (a Principal aquifer) and the London Clay Formation.
- 1.2.3 The Made Ground ranged in thickness between 0.15 and 1.5m (average 0.8m) and typically comprised clayey gravel or gravelly clay with fragments of concrete, brick and stone. The coarse grained fraction also included chalk, charcoal, ash, slag and metal fragments. A thin horizon of Brickearth was encountered below the Made Ground in about half of the exploratory holes. Its average thickness was 0.5m (ranging between 0.1 and 1.6m) and it comprised firm gravelly and/or sandy silty clay. The Lynch Hill Gravel (dense sandy flint gravel) was reached at 0.3 to 2.4m bgl and ranged in thickness between 0.9m and 4.8m (average 3.2m), generally thickening towards the west. The deepest lithology encountered was the London Clay, reached at between 2.9 and 6.1m bgl, and comprising firm-stiff grey-brown silty clay (base not proven).
- 1.2.4 Monitoring of resting groundwater indicated depths of between about 0.8 and 2.8mbgl within the Lynch Hill Gravel aquifer. Groundwater flow is for the most part directed towards the south-east at a gradient of approximately 1:130 to 1:150.

- 1.2.5 Laboratory chemical analysis was carried out on representative soil and groundwater samples and the data compared to appropriate Generic Assessment Criteria for sites with a 'Residential' end use and protective of a Principal aquifer.

### 1.3 Ground Contamination

- 1.3.1 The two intrusive investigations indicate a degree of hydrocarbon impact to shallow Made Ground soils at the northern / north-western end of the site. This is mostly around a former boiler house and disused fuel (diesel and heavy fuel oil) storage tanks. Recorded historical fuel spillages and possibly unrecorded fuel losses likely account for this. Isolated pockets of shallow perched groundwater may also have been impacted by hydrocarbons but there is no indication that the Principal gravel aquifer has been affected.
- 1.3.2 Localised elevated PAH and lead concentrations were detected in shallow soils below and to the south-east of the Main Building and in the south-eastern part of the site. These are probably attributable to sporadic fragments of ash and slag entrained within the Made Ground.
- 1.3.3 Fragments of asbestos-containing material and/or loose asbestos fibres were detected in shallow soils locally, including below the former boiler house; on the northern boundary; in the south-eastern sector; and below the Main Building.
- 1.3.4 Anecdotal evidence of 'globules' of elemental mercury existing below the old boiler house has not been confirmed and the extent of such impacts is uncertain. The laboratory data suggests some potentially elevated concentrations above 'background' levels but below applicable generic assessment criteria.
- 1.3.5 There is no indication of elevated concentrations of hazardous ground gases and concentrations of volatile vapours are relatively low.
- 1.3.6 A degree of environmental remediation is anticipated to be required to facilitate the proposed redevelopment. This may comprise:
- Off-site disposal of any severely TPH and PAH-contaminated soils, or (if feasible) excavation and ex-situ remediation to allow re-use within the site.
  - Installation of a cover layer of imported topsoil in new residential gardens or areas of communal soft landscaping (including in the commercial development area).
  - Removal – as far as reasonably practicable - of asbestos from shallow soils (hand picking).
- 1.3.7 There is considered to be no evidence of significant or unacceptable chemical impacts to the Principal Lynch Hill Gravel aquifer. Furthermore the extensive thickness of low permeability London Clay deposits would prevent any downward contaminant migration into the sensitive Chalk aquifer. At this stage therefore, specific groundwater remediation is not anticipated to be necessary, although pockets of 'contaminated' perched water in the Made Ground may require removal and treatment during any soil remedial work.

- 1.3.8 Further detailed investigations are recommended in the area reported to be potentially affected by elemental mercury. Allowance should be made for additional remedial work to address this matter (e.g. localised soil excavation or potentially other more extensive treatment). It would also be appropriate to carry out further site-wide investigations once manufacturing has ceased at the site and access to all areas – particularly below the existing building footprints - is more readily available.

## 1.4 Geotechnical Considerations

- 1.4.1 For the proposed new commercial development and low-rise residential units (up to four storeys) it is considered that conventional pad or strip foundations bearing onto the dense granular (sand and gravel) Lynch Hill Gravel would be suitable. A nett allowable bearing capacity of the order of 200kN/m<sup>2</sup> can be assumed, at a depth of approximately 2m below current ground levels, and limiting settlements to within tolerable limits (25mm).
- 1.4.2 For new residential blocks of five storeys or more, it is likely that piled foundations extending some depth into the London Clay Formation will be required. Pile type, selection and design would need to be undertaken in conjunction with a reputable specialist piling contractor.
- 1.4.3 Given the likely extensive disturbance of the top 1 to 2m of soil during site clearance activities, ground improvement will be required to allow the use of ground bearing floor slabs for new buildings. Consideration should be given to the use of vibro stone columns or low energy dynamic compaction.
- 1.4.4 Buried obstructions were encountered during the intrusive investigations in several of the exploratory holes and it is likely that numerous underground structures and obstructions exist. Due allowance should be made for removing or penetrating such features to facilitate the development.
- 1.4.5 Buried concrete should be designed on the basis of a Design Sulphate Class of DS-2 and an Aggressive Chemical Environment for Concrete Class of AC-2.

## 2. Introduction

### 2.1 Appointment

2.1.1 Capita Property and Infrastructure Limited was appointed by SEGRO plc (the Client) to undertake a Geoenvironmental Investigation and Assessment of the Nestlé UK Ltd premises at North Hyde Gardens in Hayes, Middlesex.

### 2.2 Background and Report Purpose

2.2.1 At the time of the Capita assessment (October and November 2014) the subject site comprised an operational Nestlé factory used for the manufacturing of instant coffee, and previously also for chocolate production. It is understood that the factory is to close at the end of 2014, following which the site may be sold by Nestlé for redevelopment. SEGRO is considering acquiring the site with a view to bringing forwards a mixed use scheme comprising commercial properties and housing, potentially including multi-storey residential blocks.

2.2.2 In the context of a possible acquisition by SEGRO, this report is intended to provide an assessment of potential ground contamination risks at the site. It is also intended to provide outline geotechnical information for future civil/structural design purposes.

2.2.3 To this end, the following broad objectives have been defined:

- Summarise existing information regarding the site's environmental setting and previous development history.
- Confirm the stratigraphy underlying the site through physical investigation.
- Undertake Generic Quantitative Risk Assessments to determine the potential significance of any ground contamination encountered.
- Provide recommendations on geotechnical matters including foundations and floor slabs and other associated considerations potentially affecting the redevelopment.

### 2.3 Previous Reports

2.3.1 Capita has been provided with copies of the following reports which were produced for Nestlé UK Ltd by Geosyntec Consultants Ltd:

- Phase 1 Environmental Assessment of the Nestlé UK Ltd Facility in Hayes, Middlesex. Project ref. GCU0124020 dated September 2013.
- Phase 2 Environmental Assessment of the Nestlé UK Ltd Facility in Hayes, Middlesex. Project ref. GCU0124024 dated June 2014.
- Subsurface Asbestos Investigation: Main Building Undercroft & South-Eastern Surrounding Area. Project ref. GCU0124025 dated July 2014.

- Letter report titled *Update on Groundwater Monitoring Results post September-14 round* dated 23 October 2014.

## 3. Site Location, Description and History

### 3.1 Location

- 3.1.1 The Nestlé premises are located off North Hyde Gardens in Hayes, approximately centred on post code UB3 4RF and at Ordnance Survey National Grid Reference 510100, 179190. A location plan is provided in Appendix A.

### 3.2 Site Description

- 3.2.1 The site covers an area of just over 12 hectares and is roughly rectangular in plan shape. At the time of investigation it was occupied by a number of factory buildings, the largest of which was an early 20<sup>th</sup> Century Art Deco style four-storey structure known as the Main Building with offices to the upper levels. The Main Building also housed roasting and drying plants and chocolate manufacturing facilities. Other buildings at the site included a boiler house and coffee grounds combustion plant (CGPP), situated adjacent to the north-west corner of the Main Building; two single storey warehouses on the eastern side of the site, for green bean storage and for packing operations; the 'Out of Home' (OOH) building, used for manufacturing products for business customers; a roaster and 'R Plant' building and a disused amenities building. It is estimated that between them these buildings covered about 50 to 60% of the total site area.
- 3.2.2 Externally the site was surfaced with a mix of hardstandings, including a large concrete service yard to the west of the Out of Home building and a macadam car park in the site's south-eastern corner. Soft landscaping, including numerous mature trees, was present in the central southern sector and a former blowing green and grass tennis court were located in the south-western corner, west of the amenities block.
- 3.2.3 A number of above ground fuel storage tanks (for heavy fuel oil – HFO – and diesel) were situated on the northern boundary, within concrete bunds, and a bulk storage tank for sodium hydroxide was also noted. It is understood that the HFO tanks were converted to store softened water for use in boilers in the early 1990s, and that the diesel tanks are also disused (the boilers now being gas fired).
- 3.2.4 The site is ostensibly flat, although reference to a recent topographical survey (by others) indicates ground levels range from a high of about 31.4mAOD in the north-western corner to a low of about 28.7mAOD on the south-eastern boundary. This suggests a slight fall from northwest to southeast.

### 3.3 Site Operations

- 3.3.1 Reference to the 2013 Phase 1 report provides the following summary of coffee manufacturing operations at the site:
- Green coffee received (green bean warehouse).
  - Blending operation (R Plant) – R Plant roasters are located on the 3rd floor; also extraction and spray drying area.

- Roasting operation (Roaster Building).
- Coffee ground and extracted (R Plant).
- Spray or freeze drying operation (the latter started in 1962). Spray drying in R Plant and freeze drying in the Main Building.
- Fill and Packaging lines (Eden Building) – jars, pouches, up to 300kg bags.
- Final preparation and canning line for Out of Home products (in OOH building).

3.3.2 It is understood that chocolate manufacturing took place at the site from the 1930s until 2005, but Capita is not in possession of any particular details in this regard. The associated plant and machinery was reportedly removed from site when these operations ceased. Further discussion of the site history is provided in Chapter 4 below.

3.3.3 It is also noted that a separate boiler house building was previously located to the north-west of the Main Building. This was demolished in the 1990s when a new boiler house was constructed adjoining the Main Building. The outline of the former boiler house remains visible on the surface.

3.3.4 An extract of the Geosyntec Phase 1 report illustrating the site layout (as at June 2014) is provided in Appendix G.

## 3.4 Boundaries and Surrounding Land Use

3.4.1 The site is bordered to the south by Nestles Avenue, beyond which are residential properties. The eastern boundary is defined by North Hyde Gardens with a large electricity substation beyond. The eastern half of the northern boundary is defined by the Grand Union Canal and the western half is marked by a railway line at the top of a sloped embankment. Light industrial units are situated immediately west of the site and Hayes train station is located about 150m beyond the western site boundary.

## 3.5 Mapped Development History

3.5.1 Historical Ordnance Survey map extracts were obtained for the 2013 Phase 1 assessment. These indicated that the site was generally utilised for agricultural purposes from at least the 1860s until the late 1920s or early 1930s. A 1932 OS extract is the earliest to show development at the site, with the present day Main Building indicated and a number of smaller buildings also shown – collectively labelled a Cocoa Factory. A sports ground covered the western part of the site.

3.5.2 By the 1960s a small extension had been added to the Main Building and a garage was situated in the south-eastern sector. Further extension to the Main Building took place during the 1960s and the bowling green and tennis court were built. By the 1970s the site was broadly in its present day configuration.

- 3.5.3 Notable off-site land use included a creosoting works 150m to the east (on the northern side of the canal) from the 1890s to the 1960s. A number of other works were located to the north-west beyond the railway line and development – both commercial and residential – of the surrounding areas continued throughout the 20<sup>th</sup> Century.



## 4. Environmental Setting

### 4.1 Geology

4.1.1 Reference to the British Geological Survey online GeoIndex indicates the site to be underlain by 'Worked Ground' over natural soils of the Lynch Hill Gravel Member. The Lynch Hill Gravel is part of the Maidenhead Formation and typically comprises river terrace sands and gravels. The underlying bedrock is mapped to comprise the London Clay Formation (silty clay), which is expected to be circa 60m thick.

4.1.2 The previous Geosyntec investigation, which comprised a series of window samples and boreholes to a maximum depth of 6m below ground level, encountered the following stratigraphy:

**Hard surfacing:** 0.1 to 0.4m reinforced concrete, although locally (along the northern boundary) two concrete layers up to 0.8m thick were recorded.

**Made Ground:** typically 0.5 to 1m thick (maximum 1.8m) comprising building rubble and becoming clayey with depth. Slag type materials encountered along the northern boundary and south-eastern sector.

**Unnamed Glacial Deposits (possibly Brickearth / Langley Silt):** clayey gravel / gravelly clay with rare thin (0.2m) layer of 'peaty silt'.

**Lynch Hill Gravel Member:** 1 to 4m of sands and gravels.

**London Clay Formation:** Encountered beneath the Lynch Hill Gravel and found to comprise firm to stiff brown/grey clay, base not proven (>6.4mbgl).

### 4.2 Hydrogeology

4.2.1 The Lynch Hill Gravel is designated a Principal aquifer by the Environment Agency. The underlying London Clay Formation is categorised as an Unproductive stratum (i.e. a non aquifer).

4.2.2 The site is not situated within an EA-designated Groundwater Source Protection Zone.

4.2.3 Resting groundwater depths were recorded on three occasions by Geosyntec between December 2013 and May 2014 and ranged between about 0.6 and 2.5m below ground level.

4.2.4 Within the water-bearing Lynch Hill Gravel (i.e. excluding any perched water in overlying Made Ground / Brickearth deposits) reduced water levels ranged between 30.2 and 28.0m AOD. Flow was concluded to be directed towards the south-east at a gradient of approximately 0.0075 (0.75%).

### 4.3 Groundwater Abstractions

- 4.3.1 The 2013 Phase 1 report advises that there are two deep groundwater abstraction wells within the site boundaries. One remains in use by Nestlé whilst the other is reported never to have been commissioned (apparently due to insufficient productivity).
- 4.3.2 The operational well is located centrally at the northern end of the Main Building (indicated on the site plan in Appendix G) and is licensed for use as a boiler feed and for evaporative cooling. A permitted abstraction rate of up to 54m<sup>3</sup>/hour (1,296 m<sup>3</sup>/day; 473,040 m<sup>3</sup>/year) is reported and the water is drawn from the deep Chalk aquifer, below the London Clay.
- 4.3.3 There are two other groundwater abstraction licenses within 1km of the site. These are held by Thorn EMI Electronics Ltd and USC Europe UK Ltd also for boiler or cooling purposes.

### 4.4 Hydrology

- 4.4.1 The nearest significant surface watercourse is the Grand Union Canal, which defines much of the site's northern boundary.
- 4.4.2 The River Crane is situated about 175m east of the site and flows in a southerly direction, discharging into the River Thames about 10km to the south.

### 4.5 Landfills and Waste Management

- 4.5.1 The Phase 1 report indicates that land immediately northeast of the site, beyond the canal, and also about 250m to the east (beyond the A312) appears to have been historically used for landfilling. The landfill to the northeast was licensed to the London Borough of Ealing for inert, commercial and household waste and the last waste input date was 1936. The site to the east seems to have had a last waste input date of 31st December 1949 and was used for inert, industrial, commercial, household and special waste.

### 4.6 Radon

- 4.6.1 The Indicative Atlas of Radon in England and Wales (2007) produced by the Health Protection Agency (now part of Public Health England) indicates that the number of homes within the vicinity of the site that are above the radon action level is less than 1%. Therefore the site is considered low risk in this regard and is not in area likely to be affected by naturally occurring radon gas.

## 4.7 Previous Reported Environmental Incidents

4.7.1 The following 'environmental incidents' are listed in the Phase 1 report to have taken place at the site:

1. Heavy Fuel Oil (HFO) and diesel spill in 1998

This incident is reported to have involved the "pollution" of the Grand Union Canal with HFO and/or diesel following the over-filling of a fuel storage tank in July 1998 and led to an EA prosecution under the 1991 Water Resources Act. The Phase 2 report notes that "the site area adjacent to the Grand Union Canal has been the subject of extensive soil excavation and replacement works, following the identification and remediation of fuel contamination which at one time impacted the canal." Therefore, whilst there may be some residual impact following this incident, the majority of affected soils can be expected to have been removed.

2. Diesel (Gas Oil) Fuel Leak (underground leakage up to early 1990s)

Diesel-impacted soils were reportedly detected during excavations formed for a new de-aerator tank for the boiler house. The source was attributed to leaking underground fuel lines and is not clear whether remedial work was subsequently undertaken.

3. Mercury losses to ground up to early 1990s

Mercury contamination of soils was reportedly observed by Nestlé operatives (or their subcontractors) in shallow soils during construction of the coffee ground combustion plant. The source was concluded to have been switches such as outlet damper controls and boiler pressure controls used within the former (now demolished) boiler house. Such switches are understood to have used a small ball of elemental mercury to allow the switch to move. The number of boilers was apparently no more than 3-4 so the number of mercury switches is expected to have been small.

4. Small Diesel loss (2009)

A tank on a fuel delivery truck is reported to have ruptured whilst making a delivery to site leading to the loss of approximately 700 litres of diesel. No further details are provided, although the incident is anticipated to have occurred at the northern end of the site close to the fuel storage tanks.

5. Asbestos Containing Materials in soils below the Main Building

An undercroft is reported to be present below the eastern side of the Main Building. Asbestos is understood to have been used within service ducts which pass through this area. An investigation of this issue was undertaken by Geosyntec in 2014 and the findings are discussed in Chapter 5 below.

## 5. Previous Ground Contamination Assessments

### 5.1 Introduction

5.1.1 Two intrusive ground investigations have been undertaken on behalf of Nestlé by Geosyntec Ltd. The first (reported June 2014) comprised assessment of soil and groundwater conditions below the whole of the site and the second specifically looked at the presence of asbestos-containing materials below the Main Building.

5.1.2 A summary of the key findings is provided below.

### 5.2 Scope

5.2.1 In summary the June 2014 Phase 2 investigation comprised:

- Nine boreholes (BH1 to BH9) to base depths of between 3.9 and 6.4m bgl.
- Thirty-four window samples (WS1 to WS33 and WS36) to base depths of between 0.6m and 2.1m bgl.
- Soil and groundwater sampling and chemical analysis.
- Groundwater and ground gas monitoring.

### 5.3 Field Observations

5.3.1 The following observations of suspected ground contamination were recorded on the exploratory hole logs:

Location	Depth (mbgl)	Details
BH1	0.8 – 1.0	Black staining with oil type hydrocarbon odour.
BH9	0.8 – 1.4	Hydrocarbon sheen and odour.
WS16	0.7	Oily sheen.
WS18	0.4 – 0.65	Black tar-like coating on some gravel surfaces.
WS20	0.6 – 0.95	Iridescent sheen, strong hydrocarbon odour and tar-like staining.
WS21	0.45 – 0.85	'Unpleasant' organic odour.
WS21	1.2 – 1.7	Hydrocarbon odour.
WS23	0.5 – 0.65	Slight sheen and hydrocarbon odour.
WS24	0.25 – 0.6	Slight hydrocarbon odour.
WS28	0.75 – 0.9	Faint 'sweet' hydrocarbon odour.
WS30	1.25 – 1.4	Black staining and tar-like residue.

- 5.3.2 All of the above-listed exploratory holes were situated in the northern sector of the site, and mostly along the northern boundary. In addition, slag fragments were detected in shallow soils locally. There were also occasionally 'elevated' detections (up to 60 parts per million) of volatile organics, recorded using a portable PID, at BH09 and at WS20, WS23, WS28 and WS30.

## 5.4 Soils Analysis – Hydrocarbons

- 5.4.1 Laboratory analysis was undertaken on a total 49No soil samples for a range of determinands including total petroleum hydrocarbons (TPH), volatile organic compounds, metals and metalloids.
- 5.4.2 Moderately elevated hydrocarbon concentrations were detected as follows:

TPH Fraction	Sample location, depth (mbgl) and concentration (mg/kg)						
	BH1 0.9-1.0	BH9 1.2-1.3	WS14 0.8-0.9	WS18 0.4-0.5	WS23 0.3-0.4	WS24 0.9-1.0	WS32 0.5-0.6
Aliphatics C10-C12	85.9	28.1	<0.2	70.7	1.7	<0.2	<0.2
Aliphatics C12-C16	233	185	20	1062	69	<4	6
Aliphatics C16-C35	359	289	173	6324	545	<14	154
Aromatics C12-C16	29	81	<4	424	23	<4	<4
Aromatics C16-C21	<7	113	16	2050	123	28	32
Aromatics C21-C35	55	17	54	7543	200	141	150

- 5.4.4 Concentrations of polynuclear aromatic hydrocarbons (PAH) were only marginally above laboratory limits of detection in the majority of samples. The most elevated concentrations were:

PAH Compound	Sample location, depth (mbgl) and concentration (mg/kg)		
	WS18 @ 0.4-0.5	WS28 @ 0.6-0.7	WS30 @ 0.6-0.7
Naphthalene	1.393	5.34	2.3
Acenaphthylene	11.17	24.74	3.71
Acenaphthene	1.37	34.36	2.66
Fluorene	1.66	49.14	2.39
Phenanthrene	14.04	278.8	28.52
Anthracene	12.49	119.72	12.62
Fluoranthene	45.39	398.56	74.67
Pyrene	79.31	301.49	71.83
Benzo[a]anthracene	20.86	152.22	38.33
Chrysene	25.85	128.96	38.44
Benzo[a]pyrene	41.47	136.2	58.55
Indeno[123-cd]pyrene	32.51	74.32	36.02
Dibenz[ah]anthracene	3.69	11.02	4.81
Benzo[ghi]perylene	30.27	72.29	37.72
Benzo[b]fluoranthene	46.48	154.03	60.44
Benzo[k]fluoranthene	18.07	59.9	23.51

- 5.4.5 Analysis of three soil samples for poly chlorinated biphenyls (PBCs) recorded concentrations below detection limits.
- 5.4.6 Thirty-one soil samples were analysed for a suite of volatile organic compounds. Trace concentrations of toluene were detected in five samples (maximum 0.057 mg/kg in WS36 at 1.4-1.5m) and similarly low concentrations of aromatic VOCs were also detected locally. The maximum total VOC concentration was 1 mg/kg (BH1 at 0.9-1.0m).

## 5.5 Soils Analysis – Metals and Metalloids

- 5.5.1 In respect of metals and metalloids, some moderately elevated concentrations of arsenic, lead and chromium were detected in a small number of samples, as highlighted in bold in the table below:

Determinand	Sample location, depth (mbgl) and concentration (mg/kg)						
	GAC * mg/kg	WS9 0.3-0.4	WS10 0.7-0.8	WS12 0.8-0.9	WS13 0.7-0.8	WS24 0.9-1.0	WS29 0.7-0.8
Arsenic	32	<b>37.1</b>	<b>79.8</b>	<b>37.5</b>	12.8	14.1	<b>35.9</b>
Hexavalent Chromium	4.3	<0.3	0.3	<0.3	<b>13.8</b>	0.5	0.4
Lead	450	352	<b>701</b>	286	24	<b>766</b>	372

\* Geosyntec Generic Assessment Criteria assuming residential with gardens end use.

## 5.6 Soil Analysis – Mercury

- 5.6.1 The Phase 2 report states that:

*“Mercury contamination was first identified at the site when enabling work involving excavation of Made Ground and soils was completed for the Coffee Grounds Combustion Plant (CGCP) on the south side of the existing boiler house in the early 1990s. It was reported that small amounts of elemental mercury (Hg) was found in some of the excavated soils. This was linked to the former use of mercury switches in the boiler house (outlet damper controls and boiler pressure controls), which were a relatively fragile design and did break.”*

- 5.6.2 The following results were considered potentially indicative of mercury impact, although all are well below the adopted GAC of 238mg/kg:

Determinand	Sample location, depth (mbgl) and concentration (mg/kg)					
	BH1 0.9-1.0	WS1 0.7-0.8	WS13 0.7-0.8	WS19 0.7-0.8	WS21 0.7-0.8	WS30 0.6-0.7
Mercury (inorganic)	11.8	15.7	7.3	41.7	10.2	8.1

- 5.6.3 Analysis for elemental mercury was also undertaken and indicated extremely low concentrations of between <0.00002 to 0.0047 mg/kg, compared with a GAC (assuming residential with gardens end use) of 0.17 mg/kg.

## 5.7 Soils Analysis – Asbestos

5.7.1 Of thirty-nine samples screened for the presence of asbestos, six were reported to contain either free fibres (chrysotile or amosite) or non-fibrous asbestos containing materials, as tabulated below:

Sample Location	Sample depth (mbgl)	Mass (%)	Details
WS18	0.4-0.5	0.002	Amosite/chrysotile within insulation debris (non fibrous)
WS20	0.6-0.7	0.001	Chrysotile (free fibres)
WS21	0.7-0.8	<0.001	Chrysotile (free fibres)
WS29	0.7-0.8	0.001	Chrysotile (free fibres)
WS30	0.6-0.7	<0.001	Amosite/Chrysotile (free fibres)
BH5	0.9	0.003	Chrysotile in asbestos cement fragment

5.7.2 Further discussion of asbestos detections in shallow soils is provided in Section 5.10.

## 5.8 Groundwater Analysis

5.8.1 Groundwater samples were analysed from monitoring wells installed at locations BH1 to BH9 in December 2013 (excluding BH4), in February 2014 (selected locations only) and in May 2014 (all nine wells sampled). These samples were all from the Lynch Hill Gravel aquifer.

5.8.2 The following notable observations are set out in the Phase 2 report:

### BH1

Mercury (GAC 1 µg/l): 3 to 41 µg/l  
Arsenic (GAC 10 µg/l): 15 to 30 µg/l  
Nickel (GAC 20 µg/l): 18 to 44 µg/l  
Total PAH: 7.2 to 12.4 µg/l

### BH2

Hexavalent chromium (GAC 50 µg/l): <30 to 50 µg/l  
Total PAH: 1.6 to 30 µg/l

5.8.3 There were no detectable concentrations of TPH in any of the groundwater samples and only one sample (BH2) yielded a detectable (but low) concentration of any VOCs (toluene at 0.5 µg/l).

5.8.4 In addition to analysis of the gravel aquifer, four shallow perched water samples (from WS17, WS22, WS28 and WS36) were tested. No significant matters of concern were recorded.

5.8.5 Two samples of groundwater were also obtained from the operational deep groundwater abstraction well, which draws water from the Chalk Principal aquifer. These both recorded no organic compounds above laboratory limits of detection (LOD) and inorganic were also mostly below the LODs.

- 5.8.6 Further groundwater monitoring was undertaken by Geosyntec in September 2014 and reported separately in their letter of 23<sup>rd</sup> October 2014. The concentration of dissolved mercury at location BH1 is reported to have fallen from a high of 41 µg/l in February 2014 to 20.2 µg/l in September 2014. This was considered by Geosyntec to reflect a reduction in pH during the same period (a higher pH being more likely to mobilise soil-bound mercury into the groundwater). In all other wells, mercury was reported to be close to or below the GAC of 1 µg/l.
- 5.8.7 In respect of total PAH compounds, concentrations at BH2 are reported to have fallen from 30 µg/l in December 2013 to about 3 µg/l in September 2014. Trace concentrations were also reported at BH1, BH8, BH9 and WS28 however the letter concludes that “it is unlikely that any of these concentrations pose any significant risk to a wider environment.”

## 5.9 Ground Gases

- 5.9.1 Ground gas monitoring was undertaken in February and May 2014. Methane was not detected at measurable concentrations (other than an erroneous measurement at WS3 attributed to a nearby leaking gas main) and the maximum carbon dioxide level was 1.1% by volume. As such the site was concluded to present a very low risk in respect of ground gases.

## 5.10 Subsurface Asbestos Investigation

- 5.10.1 The July 2014 Geosyntec report titled Subsurface Asbestos Investigation was undertaken to assess the extent of asbestos contamination in the soils within the undercroft below the Main Building. It is reported to have been prompted by a 2007 survey which identified that ACM lagging on pipes in the undercroft had deteriorated and fallen to the surface, which is not covered by hard standing. Soils were indicated potentially to have become impregnated with ACM down to 0.75-1m below the undercroft surface.
- 5.10.2 The investigation comprised 25No window sample holes (U1 to U21 and C1 to C4) drilled through the existing Main Building ground floor slab and extending up to 1m into the soils below the undercroft ground surface. 5No additional holes (WS101 to WS105) were drilled just outside – to the south east of – the building.
- 5.10.3 A total of 88No soil samples were analysed for asbestos containing materials, of which 72No recorded “no asbestos detectable” (relating to 17 of the 28 sampling locations). 9No recorded “trace” levels and 7No recorded “quantifiable” concentrations – the latter being a maximum of 0.001%.
- 5.10.4 Some of these samples were also submitted for Waste Acceptance Criteria analysis and notable results included:
- WS102 @ 0.55m  
Total PAH: 4,925 mg/kg  
TPH: 17,876 mg/kg (predominantly aromatics >C16)
- U21 @ 0.02-0.1m  
TPH: 1,873 mg/kg



- 5.10.5 Separately from the soil screening, 32 No dust/debris samples from the undercroft near surface were also analysed for ACM. Chrysotile and amosite are reported to have been identified in 8 No of these samples.

## 6. Preliminary Conceptual Model

### 6.1 Introduction

6.1.1 A preliminary Conceptual Site Model (CSM) has been developed by Capita in the context of the proposed site redevelopment to summarise potential ground contamination risks on the basis of the existing information set out in this report. The CSM was used to inform the design and requirements of the intrusive investigation.

### 6.2 Contaminated Land Legislative Background

6.2.1 Part 2A of the Environmental Protection Act 1990, implemented by Section 57 of the Environment Act 1995, provides a statutory definition of contaminated land in which land is only defined as contaminated if there is a significant “contaminant linkage”. Statutory Guidance in relation to the Act was published by DEFRA in April 2012 and confirmed that for a risk to exist there must be one or more contaminant-pathway-receptor linkages by which a relevant receptor might be affected by the contaminants in question. All three elements of a linkage must be present before land can be considered potentially to be contaminated.

6.2.2 The development of a Conceptual Site Model comprises a review of available data to establish the potential presence and nature of contaminants, pathways and receptors. In the case of this assessment the data includes the site’s environmental setting and sensitivities, its current and historical land use, the previous investigation reports and the proposed development type. Where a contaminant linkage could be present, the status is described as potentially active. This does not necessarily mean that a risk exists, but that further risk assessment is required which could include intrusive investigation and/or modelling.

6.2.3 The determination of potentially active linkages comprises the Preliminary Risk Assessment (‘PRA’ as defined in DEFRA and EA (2004)). The definition of Areas of Potential Concern (APCs) brings together any relevant groups of contaminant linkages and forms the basis/rationale for further works.

### 6.3 Conceptual Site Model

6.3.1 The following potential contaminant linkages are considered to exist:

Source		Pathways	Receptors
Primary	Secondary		
<ul style="list-style-type: none"> <li>• Historical above ground fuel and/or chemical storage tanks</li> <li>• Historical fuel spillages</li> <li>• Made Ground/ Fill materials</li> </ul>	<ul style="list-style-type: none"> <li>• Petroleum hydrocarbons</li> <li>• BTEX compounds</li> <li>• PAHs</li> <li>• Volatile organic compounds</li> <li>• Metals – particularly</li> </ul>	<ul style="list-style-type: none"> <li>• Groundwater migration</li> <li>• Infiltration and leaching</li> <li>• Direct ingestion</li> <li>• Dermal contact</li> <li>• Inhalation</li> <li>• Plant uptake</li> <li>• Vertical migration (e.g.</li> </ul>	<ul style="list-style-type: none"> <li>• Current site occupants</li> <li>• Adjacent site occupants</li> <li>• Construction (and demolition) workers</li> <li>• Future site users</li> <li>• Groundwater</li> </ul>

Source		Pathways	Receptors
Primary	Secondary		
<ul style="list-style-type: none"> <li>• Reported mercury impact to shallow soils</li> </ul>	mercury <ul style="list-style-type: none"> <li>• Sulphates</li> <li>• Asbestos</li> <li>• Inorganics</li> <li>• Ground gases</li> </ul>	via new piled foundations)	(Principal Gravel aquifer) <ul style="list-style-type: none"> <li>• Surface water – Grand Union Canal</li> <li>• Surface Water – River Crane</li> <li>• Future buildings and services (including potable water supply pipes)</li> <li>• Future landscaping</li> </ul>

6.3.2 The principal Areas of Potential Concern (APC) which the intrusive investigation was intended to address were:

Area of Potential Concern	Comment
Groundwater	Given the site's Principal aquifer designation and the recorded past hydrocarbon impacts, groundwater quality should be assessed as part of the intrusive investigation.
Made Ground	Assessment of shallow soil samples should be carried out for a range of possible chemical contaminants.
Ground Gases	There is no evidence of elevated ground gases having previously been identified however this matter should be re-assessed in the context of the development proposals.

## 7. Ground Investigation – Capita 2014

### 7.1 Scope

7.1.1 Intrusive ground investigation works were undertaken by Capita over the period 6<sup>th</sup> to 21<sup>st</sup> October 2014 and comprised:

- 13No boreholes (BH101-BH113), predominantly by cable percussion but also using a Comacchio Geo250 rotary percussion rig at BH112 and BH113 and a Competitor rig at BH108.
- Installation of HDPE monitoring standpipes (50mm internal diameter) in BH101-BH104, BH107-BH109 and BH111-BH113, with pipe base depths ranging between 1.2 and 6.3m. All the standpipes were constructed with response zones sealed within the Lynch Hill Gravel aquifer other than at BH103 which – due to encountering an obstruction – was sealed in the Made Ground.
- Collection of representative soil samples for laboratory chemical and geotechnical testing.
- Groundwater samples were collected for chemical analysis from all of the 2014 boreholes and selected pre-existing wells.
- Ground gas and water level monitoring was undertaken at the site on three occasions in October and November 2014.

7.1.2 Exploratory hole locations are shown in relation to the current site layout in Figure 001/P02 in Appendix A. Stratigraphic and (where applicable) monitoring well installation details are shown on the logs in Appendix B.

### 7.2 Chemical Testing

7.2.1 18No soil samples obtained from the Capita exploratory holes were submitted to i2 Analytical Ltd, Watford for analysis of a range of chemical determinands.

7.2.2 Based on visual inspection of the ground, the findings of the previous investigations and the PCM, the soil samples were tested for the following potential contaminants:

- Total Petroleum Hydrocarbons (TPH) speciated for the Criteria Working Group (CWG) suite of hydrocarbon bands;
- Speciated (US EPA 16) Polycyclic Aromatic Hydrocarbons (PAH);
- Benzene, toluene, ethyl benzene and xylenes (BTEX)
- Metals and metalloids (As, B (w/s), Cd, Cr, Cu, Hg, Ni, Pb, Se, V, Zn);
- Water soluble sulphate;
- pH;

- Asbestos (screen).

7.2.3 17No groundwater samples (obtained from the Capita wells and selected previously installed monitoring points) were tested for some or all the following analysis suite:

- Total Petroleum Hydrocarbons (TPH) speciated for the Criteria Working Group (CWG) suite of hydrocarbon bands;
- Speciated (16) Polycyclic Aromatic Hydrocarbons (PAH);
- Benzene, toluene, ethyl benzene and xylenes (BTEX)
- Volatile Organic Compounds (VOC)
- Metals and metalloids (As, B, Cd, Cr, Cu, Hg, Ni, Pb, Se, V, Zn);
- pH;
- Sulphate.

7.2.4 Results of all the chemical testing are presented in the laboratory reports in Appendix C.

## 7.3 Geotechnical Testing

7.3.1 In-situ geotechnical testing was undertaken at regular intervals during the investigation in the form of Standard Penetration Tests (SPTs); the results of this testing are presented on the borehole logs. Laboratory geotechnical testing was undertaken on selected samples by Geolabs Ltd, Watford as follows:

- Eight samples submitted for plasticity index analysis (Atterberg Limits);
- Four samples tested for undrained shear strength in triaxial compression (single stage);
- Eight samples tested for particle size distributions (wet sieve without pipette analysis);
- Twelve samples tested for determination of natural moisture content;
- Six samples tested for the BRE-SD1 ground aggressivity suite.

7.3.2 Results are presented in the laboratory reports in Appendix E.

## 7.4 Gas and Groundwater Monitoring

7.4.1 Follow-up ground gas and groundwater monitoring was carried out on 29<sup>th</sup> October and 5<sup>th</sup> and 18<sup>th</sup> November 2014 with the full datasets presented in Appendix F.

## 8. Ground Conditions

### 8.1 Introduction

- 8.1.1 The stratigraphic sequence encountered during the Capita investigation compared well with that previously described at the site. In summary, surfacing comprising either reinforced concrete, macadam or topsoil was encountered overlying Made Ground, discontinuous Brickearth/ Langley Silt, Lynch Hill Gravel and the London Clay Formation. The base of the London Clay was not reached (>6.5mbgl).
- 8.1.2 The table below summarises conditions encountered within all of the exploratory holes (i.e. those installed by Geosyntec and by Capita:

Stratum	Thickness range (m)	Depth range to top of stratum (mbgl)	Depth range base depth (mbgl)
Concrete / Macadam / Topsoil	0.06 to 0.80	GL	0.06 to 0.80
Made Ground	0.1 to 1.5	0.06 to 0.80	0.3 to 1.9
Langley Silt / Brickearth	0.1 to 1.6	0.4 to 1.9	0.8 to 2.4
Lynch Hill Gravel	0.9 to 4.8	0.3 to 2.4	2.9 to 6.1
London Clay	Not proven	2.9 to 6.1	Not proven

### 8.2 Surfacing

- 8.2.1 The majority of the exploratory holes were positioned in areas surfaced with reinforced concrete. Its ranged in thickness between about 0.2 and 0.6m, typically 0.3-0.4m, although in one location (WS31 within the CGCP) concrete >1.8m was reported.
- 8.2.2 Where tarmacadam was encountered (e.g. BH101, BH109, WS7) it was generally between 70 and 100mm thick. Circa 0.3m of topsoil was recorded at BH112 (former tennis court) and at BH108 (landscaped area south of the Main Building).

### 8.3 Made Ground

- 8.3.1 Made Ground was encountered below the hard surfacing or topsoil in all exploratory hole locations and ranged in thickness between 0.15 and 1.5m, averaging 0.8m. The stratum typically comprised grey or brown clayey gravel or gravelly clay with fragments of concrete, brick and stone. The coarse grained fraction also locally included fragments of chalk, charcoal, ash, slag and metal.
- 8.3.2 A particle size distribution test undertaken on a bulk sample of the Made Ground (BH108 at 0.0-0.5m) recorded a gravel fraction of 25.4%, 25.1% sand and 49.5% silt/clay.

## 8.4 Brickearth / Langley Silt

8.4.1 A thin horizon of fine grained soils interpreted to correspond with the Langley Silt / Brickearth lithology was encountered in about half of the exploratory holes. Its average thickness was 0.5m (ranging between 0.1 and 1.6m) and it generally comprised firm gravelly and/or sandy silty clay.

## 8.5 Lynch Hill Gravel

8.5.1 The Lynch Hill Gravel Member was encountered below either the Made Ground or Brickearth and ranged in thickness between 0.9m (BH4) and 4.8m (BH111), averaging 3.2m and generally thickening towards the west. The stratum comprised medium dense and dense orange-brown and dark brown sandy flint gravel, with occasional sand lenses.

8.5.2 Particle size distribution tests were undertaken on seven bulk samples of the Lynch Hill Gravel:

Location	Sample Depth (mbgl)	Cobbles	Gravel	Sand	Silt/Clay
BH101	2.5 – 3.0	0.0	65.9	31.9	2.2
BH102	3.5 – 4.0	0.0	81.3	18.6	0.2
BH104	3.0 – 3.45	0.0	85.8	10.4	3.8
BH107	2.0 – 2.5	0.0	71.0	28.8	0.4
BH109	3.0 – 3.45	0.0	77.5	17.8	4.7
BH111	1.1 – 1.6	0.0	52.9	39.6	7.5
BH112	1.2 – 2.15	0.0	52.2	40.0	7.7

8.6 Standard penetration test results within this lithology were frequently refusals (i.e. N >50), or where an 'N' value was obtained this was typically in the range N=40 to N=50, indicative of dense granular material.

## 8.7 London Clay

8.7.1 The London Clay Formation, comprising firm brown and grey silty clay, was reached in a total of 17No exploratory holes below the Lynch Hill Gravel, and its base depth was not proven (>6.7m bgl).

8.7.2 Plasticity testing of two London Clay samples indicated liquid limits of 68 and 69%, plastic limits of 32 and 33% and plasticity indices of 36 and 39%, indicative of medium plasticity clay soil.

8.7.3 The results of four quick undrained triaxial tests carried out on undisturbed samples of the London Clay are summarised as follows:

Location	Depth (mbgl)	Shear strength (kPa)
BH102	5.5-5.95	89
BH104	5.5-5.95	70
BH107	5.4-5.84	69
BH113	5.2-5.65	76

## 8.8 Visual/ Olfactory Evidence of Contamination

- 8.8.1 A faint possible hydrocarbon odour was recorded during drilling at BH111 from 4.3 to 4.5m bgl. No other observations of suspected ground contamination were noted during the Capita investigation.

## 8.9 Obstructions

- 8.9.1 Buried obstructions were recorded during the two phases of investigation at the following locations and depths:

Borehole ID	Depth (mbgl)	Details (as indicated on the logs)
BH103	1.2	Concrete obstruction
BH106	0.6	Concrete obstruction
BH109A	0.6	Concrete obstruction (borehole re-positioned 10m south as BH109)
WS7	1.0	Refusal on flat surface – possible covered void (duct)
WS11	0.66	Buried services encountered – hole abandoned
WS18	0.65	Sloping concrete obstruction
WS19	1.05	Refusal on submerged hard surface – inferred concrete obstruction
WS20	0.95	Refusal on concrete obstruction
WS23	0.65	Refusal on inferred concrete obstruction (submerged)
WS26	0.65	Refusal on hard concrete obstruction
WS27	0.75	Refusal on hard concrete obstruction
WS29	0.90	Refusal on hard concrete
WS30	1.40	Refusal on concrete cobble/slab
WS31	1.80	Refusal on concrete slab
WS32	0.6	Refusal on hard concrete obstruction

## 8.10 Groundwater / NAPL

- 8.10.1 Measurement of resting groundwater levels in selected monitoring wells was undertaken on three occasions in October and November 2014 using an oil/water interface probe.
- 8.10.2 Water depth and level data for 29<sup>th</sup> October 2014 is presented in the table below:

Borehole ID	Water depth (mbgl)	Water level (mAOD)
BH101	2.89	28.38
BH102	2.62	28.39
BH103	0.68	30.52
BH104	0.73	30.27
BH107	1.50	29.79
BH108	1.58	29.32



Borehole ID	Water depth (mbgl)	Water level (mAOD)
BH109	1.56	28.26
BH111	2.66	28.32
BH112	Dry	Dry
BH113	1.96	29.12
BH1	0.71	29.80
BH2	0.83	29.61
BH3	0.84	29.35
BH4	1.15	28.38
BH5	1.27	28.00
BH6	1.59	28.56
BH7	1.49	29.68
BH8	1.04	30.10
BH9	2.82	28.38

- 8.10.3 The 2014 monitoring data supports the previous assessment that groundwater flow is for the most part directed towards the south-east. However there appears to be some variation in the north-western sector of the site where flow appears to be directed westwards – this anomaly may be attributable to below-ground features associated with the Grand Union Canal and the railway line, which could be interrupting the prevailing regional flow. A groundwater contour plot based on the June 26<sup>th</sup> data is provided in Appendix A and indicates a gradient of circa 1:150 (0.66%). This compares well with that previously recorded (see Section 4.2)
- 8.10.4 Free phase hydrocarbons (LNAPL and DNAPL) were not detected on or below groundwater in any of the monitoring wells.

## 9. Geotechnical Appraisal

### 9.1 Proposed Development

9.1.1 It is understood that a mixed use development is under consideration for the site, comprising commercial / light industrial units and a range of residential properties including homes with private gardens and apartment blocks of up to nine stories.

### 9.2 Site Preparation

9.2.1 Prior to construction, the following geo-environmental “site preparation” activities are likely to be required:

- De-commissioning of services crossing the site;
- Earthworks (see below);
- Breaking out, as required, of all buried obstructions;
- Placement of a construction platform/blanket.

9.2.2 There will also be a need for demolition of the existing site structures, to include the removal of foundations and breaking out of existing areas of hardstanding. Certain demolition products, such as brick and concrete, should be suitable for re-use as bulk fill within the works after screening and crushing. Re-use of macadam scalping is not recommended below new buildings but may be permitted below external areas.

9.2.3 Given their age it is likely that asbestos-containing materials were used in construction/ refurbishment of many of the existing buildings. Therefore, prior to demolition, asbestos surveys should be undertaken in all existing structures, by qualified persons. Any asbestos identified would need to be removed in accordance with current regulations.

### 9.3 Existing Basement and Buried Obstructions

9.3.1 Buried obstructions were encountered during the intrusive investigations in several of the exploratory holes (see Section 8.9) and it is likely that numerous underground structures and obstructions exist at the site. It is also likely that remnant obstructions associated with previous site buildings, such as the old boiler house, remain present. Consequently there will be a need for the excavation / breaking out and removal of such obstructions as part of the redevelopment.

9.3.2 Due consideration should be given to “party wall” issues, particularly along the northern boundary with the Grand Union Canal and on the boundary with the raised railway line to the north-west. Such consideration may need to include suitable measures to retain/stabilise ground at/adjacent to such features.

## 9.4 Earthworks

- 9.4.1 In consideration of the site topography, there is not anticipated to be a requirement for extensive earthworks to accommodate the redevelopment, although some degree of “cut-and-fill” will be necessary. From consideration of the ground conditions encountered, much if not all of the soils likely to be generated from areas of cut will be Made Ground or Brickearth. From an earthworks perspective, these are anticipated to classify as “stony cohesive fill”. Fill to be placed beneath adoptable highways should ideally be granular (of an appropriate grading), inert, chemically suitable and well-engineered. Subject to being screened and appropriately engineered, it should be feasible to re-use uncontaminated site-won Made Ground soil as bulk fill in the development, beneath car parks and other areas of proposed external hardstanding, and also beneath areas of landscaping/public open space.

## 9.5 Foundations for New Buildings

- 9.5.1 The Made Ground is considered to be an unsuitable bearing medium for the support of the proposed (major) structural foundations, as its relatively incompetent and variable nature could give rise to unacceptable magnitudes of total and differential settlements on loading. The horizontally discontinuous underlying thin Brickearth lithology is also considered not to be suitable.
- 9.5.2 For the proposed new commercial development and low-rise residential units (up to four storeys) it is considered that conventional pad or strip foundations bearing onto the dense granular (sand and gravel) Lynch Hill Gravel would be suitable. A nett allowable bearing capacity of the order of 200kN/m<sup>2</sup> can be assumed, at a depth of approximately 2m below current ground levels, and limiting settlements to within tolerable limits (25mm).
- 9.5.3 For new residential blocks of five storeys or more, it is likely that piled foundations extending some depth into the London Clay Formation will be required. Pile type, selection and design would need to be undertaken in conjunction with a reputable specialist piling contractor, ideally with local experience, and would be dependent upon the required working loads. In addition, due consideration would need to be given to the environmental impact of the selected pile installation technique (i.e. noise / vibrations), particularly upon adjoining structures, and the possibility of encountering buried obstructions during installation must also be considered.
- 9.5.4 The potential presence of ground contamination (see Section 11) within shallow soils should also be taken into account and piles must not create new pathways for downward contaminant migration. Consultation with regulators – particularly the Environment Agency – will be required in order that an acceptable piling technique is selected. It is noted that such requirements may vary following remedial works undertaken to ameliorate any ground contamination encountered.

## 9.6 Floor Slabs for New Buildings

- 9.6.1 Given likely extensive disturbance of the top 1 to 2m of soil during site clearance activities, it is advised that some form of ground improvement will be required to allow the use of ground bearing floor slabs for new buildings. In this regard consideration should be given to the use of vibro stone columns or low energy dynamic compaction.

## 9.7 Pavement Design

- 9.7.1 It is anticipated that Made Ground soils will form the majority of formations in external paved areas. These formations should be protected from the adverse effects of inclement weather and inspected and proof-rolled prior to commencement of the construction layers. All loose or otherwise deleterious material must be removed. Each formation must exhibit a consistent CBR value in excess of 3%; material which fails to do so should be removed and replaced with other, more suitable compacted fill material.
- 9.7.2 In situ testing of the sub-grade formation should be undertaken prior to construction to confirm the design CBR value.

## 9.8 Concrete Classification

- 9.8.1 The design/mix of buried concrete should be undertaken in accordance with the “Aggressive Chemical Environment for Concrete” (ACEC) classification of BRE Special Digest 1: 2005 (Concrete in Aggressive Ground). With reference to the site history, it is appropriate to classify the site as Brownfield in accordance with the BRE guidance.
- 9.8.2 Chemical testing during the Capita investigation was carried out on 11No Made Ground, 5No Brickearth, 6No Lynch Hill Gravel and 2No London Clay samples. This indicated water soluble sulphate concentrations of between 10mg/l and 1100mg/l and soil pH values in the range 8.0 to 11.2.
- 9.8.3 The mean of the highest 20% sulphate concentrations was 670mg/l and the mean of the lowest 20% pH values was 8.1.
- 9.8.4 Given the “mobile” groundwater conditions at the site 17No groundwater samples were analysed for dissolved concentrations of total sulphate; these varied between 15mg/l and 987mg/l. Groundwater pH ranged between 7.0 and 11.6.
- 9.8.5 On the basis of these results it is considered that a design sulphate (DS) class of DS2 and an “Aggressive Chemical Environment for Concrete” (ACEC) classification of AC-2 would be appropriate for buried concrete at the site.

## 9.9 Excavations and Groundwater

- 9.9.1 Excavations at the site should be feasible using an appropriate scale of hydraulic plant. Collapse of side walls is likely to occur in all excavations where groundwater is reached and these will therefore require adequate lateral support, or battering back to a safe angle, to ensure their stability.

9.9.2 Resting water depths were recorded to be between about 0.8 and 2.9m bgl during the 2014 Capita investigation. Groundwater is therefore likely to be encountered in shallow excavations formed during the development (for example for new buried services) and appropriate allowance will need to be made for de-watering. It should be noted that disposal of groundwater from excavations requires careful management and due consideration of appropriate legislation, guidance and Duty of Care responsibilities, particularly if affected by chemical contamination (see Section 11).

## 9.10 Soakaway Drainage

9.10.1 It is anticipated that soakaway drainage into the Lynch Hill Gravel should be feasible for the proposed development. Appropriate on site testing would need to be undertaken to confirm infiltration rates in the locations at which soakaways are proposed. Cognisance must also be taken of the locally very shallow water table, which may preclude the use of soakaways in certain areas.

## 10. Ground Gas Assessment

### 10.1 Current Guidance

- 10.1.1 The assessment of potential risks from concentrations of ground gases methane and/or carbon dioxide is based on BS 8485:2007 'Code of Practise for the Characterization and Remediation from Ground Gas in Affected Developments' and CIRIA publication C665 'Assessing Risks posed by Hazardous Ground Gases to Buildings' (Wilson et al., 2007).
- 10.1.2 The methodology utilises the determination of hazardous gas flow rates based upon gas concentrations multiplied by borehole flow rates, to help define a "site characteristic hazardous gas flow rate" for the site.
- 10.1.3 On the basis of the gas flow rate, BS 8485 then allows classification of the site in terms of Characteristic Situation (CS) ranging from 1 to 6, which in turn informs the requirements of any protective / remedial measures to be incorporated into the development.

### 10.2 Assessment

- 10.2.1 Ground gas monitoring was undertaken by Capita at ten monitoring wells on three occasions in October and November 2014, using a Geotechnical Instruments GA5000 infra red gas analyser.
- 10.2.2 The table below summarises the field data (which is provided in full in Appendix F):

Standpipe	Max Flow (l/hr)	Maximum CH <sub>4</sub> concentration (%v/v)	Maximum CO <sub>2</sub> concentration (%v/v)	Minimum O <sub>2</sub> concentration (%v/v)
BH101	1.1	0.0	0.8	20.0
BH102	0.1	0.5	1.1	6.1
BH103	0.2	0.0	0.0	18.7
BH104	7.7	0.3	1.1	15.3
BH107	0.0	0.2	1.0	18.1
BH108	0.0	0.0	3.0	14.4
BH109	0.0	0.0	0.1	17.8
BH111	0.0	0.7	0.0	3.1
BH112	1.0	0.0	1.3	18.6
BH113	1.8	0.0	1.7	10.2

NB: Analyser detection limits are 0.1% v/v for gas concentrations and 0.1l/hr for flow rate.

- 10.2.3 Methane was detected at trace concentrations in four locations, up to a maximum of 0.7% by volume (BH111). The maximum carbon dioxide concentration was 3.0% (BH108).
- 10.2.4 Hazardous gas flow rates were below 0.07l/hr in all locations, indicating that the site corresponds to characteristic gas situation 1 ("CS1") and presents a very low risk with respect to ground gases.
- 10.2.5 This also corresponds with the previous Geosyntec data (see Section 5.9) and as such no special protection measures are likely to be necessary for the proposed development.

# 11. Generic Quantitative Risk Assessment

## 11.1 Introduction

- 11.1.1 In line with CLR11 (DEFRA & EA, 2004), a Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of any recorded chemical impacts at the site. The GQRA comprises the comparison of the measured 'contaminant' concentrations with Generic Assessment Criteria (GACs).
- 11.1.2 The GACs for soil concentrations have been derived using CLEA version 1.6. The GACs for "liquid" concentrations comprise either drinking water standards or environmental quality standards protective of a Principal Aquifer.
- 11.1.3 On the basis of current development proposals the GQRA for soils has been undertaken assuming the conservative "residential with gardens" end-use as defined in SR3 with the soil type selected being a sandy soil with 1% organic matter.
- 11.1.4 The relevant statistical tests have been undertaken on the laboratory data where appropriate. The findings of the GQRA are presented below and the datasheets provided in Appendix D.

## 11.2 Laboratory Analysis – Soils

- 11.2.1 18No soil samples were laboratory screened for the presence of asbestos containing materials. A result of 'no asbestos detected' was reported for 15No of the samples with the following reporting positive detections:

BH104 at 0.3m: Amosite - Loose fibres and Chrysotile - Insulation lagging

BH109 at 0.65m: Chrysotile - Loose fibres

BH109 at 1.4m: Chrysotile - Loose fibres

- 11.2.2 The samples were also analysed for a suite of typical metal and metalloid contaminants. The table below summarises the results:

Determinand	GAC (mg/kg)	Range of Results (mg/kg)	No. samples exceeding GAC
Arsenic	32	7.1 - 32	0
Boron	94	0.2 - 2.3	0
Cadmium	10	0.2 - 0.3	0
Chromium VI	34	12 - 42	3
Copper	630	7.3 - 150	0
Lead	180	4.1 - 540	4
Mercury	170	0.3 - 44	0
Nickel	130	13 - 41	0
Selenium	350	1 - 1	0
Vanadium	200	17 - 73	0
Zinc	2200	20 - 450	0

11.2.3 The results indicate the following exceedances of the GACs:

Chromium VI: GAC 34 mg/kg

BH109 at 1.4m: 41 mg/kg

BH112 at 0.65m: 42 mg/kg

BH113 at 1.4m: 42 mg/kg

Lead: GAC 180 mg/kg \*

BH102 at 0.3m: 540 mg/kg

BH102 at 1.4m: 260 mg/kg

BH107 at 0.8m: 200 mg/kg

BH109 at 0.65m: 420 mg/kg

\* N.B. The 450mg/kg GAC adopted by Geosyntec would suggest fewer exceedances than listed here.

11.2.4 Laboratory analysis was carried out for Total Petroleum Hydrocarbons and results are summarised as follows:

Determinand	GAC (mg/kg)	Range of Results (mg/kg)	No. samples exceeding GAC
Aliphatic >C5-C6	17	<0.1	0
Aliphatic >C6-C8	33	<0.1	0
Aliphatic >C8-C10	7.8	<0.1	0
Aliphatic >C10-C12	44	<1	0
Aliphatic >C12-C16	210	<2 - 6.6	0
Aliphatic >C16-C21	N/A	<8 - 33	0
Aliphatic >C21-C35	N/A	<8 - 140	0
Aliphatic >C16-C35	17000	<10 - 180	0
Aromatic C8-10	11	<0.1	0
Aromatic C10-12	35	<1	0
Aromatic C12-16	91	<2 - 6.1	0
Aromatic C16-21	200	<10 - 40	0
Aromatic C21-35	790	<10 - 140	0

11.2.5 None of the samples exceeded the GAC for any of the hydrocarbon fractions, with only trace concentrations detected in a small number of locations (e.g. BH104 at 0.9m and BH102 at 0.3m).

11.2.6 Results of analysis for Polynuclear Aromatic Hydrocarbons (PAH) and BTEX were as follows:

Determinand	GAC (mg/kg)	Range of Results (mg/kg)	No. samples exceeding GAC
Benzo[a]anthracene	7.1	<0.1 - 3.3	0
Benzo[a]pyrene	1.0	<0.1 - 2.5	3
Benzo[b]fluoranthene	8.2	<0.1 - 3.1	0



Determinand	GAC (mg/kg)	Range of Results (mg/kg)	No. samples exceeding GAC
Benzo[ghi]perylene	9.8	<0.05 - 1.6	0
Benzo[k]fluoranthene	8.8	<0.1 - 1.6	0
Chrysene	66	<0.05 - 3.5	0
Dibenz[ah]anthracene	1.0	<0.1 - 0.43	0
Fluoranthene	620	<0.1 - 9.1	0
Indeno[123-cd]pyrene	7.8	<0.1 - 1.2	0
Naphthalene	5.5	<0.05 - 0.31	0
Pyrene	770	<0.1 - 6.9	0
Benzene	0.054	<0.001	0
Toluene	92	<0.001	0
Ethylbenzene	42	<0.001	0
Xylenes	20	<0.001	0

11.2.7 The three (marginal) exceedances of the GAC for benzo-a-pyrene were as follows:

Benzo-a-pyrene: GAC 1.0 mg/kg

BH103 at 0.3m: 2.5 mg/kg

BH107 at 0.8m: 1.1 mg/kg

BH109 at 1.65m: 1.5 mg/kg

## 11.3 Groundwater

### 11.3.1 Metals

11.3.2 Seventeen samples of groundwater were obtained from the monitoring wells and submitted for laboratory analysis of a typical metals suite. Applicable Capita GACs for a Principal aquifer have been used as screening criteria to assess the measured contaminant concentrations.

11.3.3 Results are summarised below:

Determinand	GAC (µg/l)	Range of Results (µg/l)	No. exceeding GAC
Arsenic	10	0.24 - 36.7	3
Boron	1000	35 - 390	0
Cadmium	3	<0.02 - 0.15	0
Chromium	50	<0.2 - 120	1
Copper	2000	4.1 - 140	0
Lead	10	<0.2 - 1.2	0
Mercury	1	<0.05 - 4.85	1
Nickel	20	1.7 - 63	1
Selenium	10	<0.6 - 75	1
Zinc	5000	<0.5 - 5.6	0

11.3.4 The results indicated the following exceedances:

Arsenic: GAC 10 µg/l

BH103: 36.7 µg/l

BH1: 30.7 µg/l

BH8: 15.5 µg/l

Chromium: GAC 50 µg/l

BH103: 120 µg/l

Mercury: GAC 50 µg/l

BH1: 4.85 µg/l

Nickel: GAC 20 µg/l

BH103: 63 µg/l

Selenium: GAC 1 µg/l

BH103: 75 µg/l

#### 11.3.5 *Petroleum Hydrocarbons*

11.3.6 The groundwater samples were also analysed for the TPH-CWG suite of hydrocarbon bands. Concentrations were below laboratory limits of detection in all samples other than BH103, where the following concentrations were recorded:

BH103

Determinand	GAC (µg/l)	Concentration (µg/l)
Aliphatic C5-6	10	<10
Aliphatic C6-8	10	<10
Aliphatic C8-10	10	<10
Aliphatic C10-12	10	<b>130</b>
Aliphatic C12-C16	10	<b>700</b>
Aliphatic C16-C21	10	<b>810</b>
Aliphatic C21-C35	10	<b>460</b>
Aromatic C8-C10	10	<10
Aromatic C10-C12	10	<10
Aromatic C12-C16	10	<10
Aromatic C16-C21	10	<10
Aromatic C21-C35	10	<10
Sum TPH	10	<b>2114</b>

### 11.3.7 BTEX

11.3.8 Concentrations of BTEX compounds (benzene, toluene, ethyl benzene and xylenes) were reported to be below detection limits (<1.0 µg/l) in all the groundwater samples other than a trace concentration of toluene at BH103 (13.5 µg/l), which was below the GAC (24 µg/l).

### 11.3.9 Polynuclear Aromatic Hydrocarbons

11.3.10 Concentrations of PAHs (US EPA 16 compounds) were generally below laboratory detection limits (<0.1 µg/l). Where detectable concentrations were recorded they were below the applicable GACs with the exception of 0.12 µg/l benzo[ghi]perylene at BH1 (GAC: 0.1 µg/l).

### 11.3.11 Volatile Organic Compounds

11.3.12 Eight of the groundwater samples were analysed for VOCs and again the vast majority of concentration were below method detection limits. The only sample to exhibit a detectable concentration was from BH103 where 2.6 µg/l 1,2,4-trimethylbenzene was recorded.

## 11.4 Discussion

11.4.1 On the basis of the field observations and laboratory analysis results from the two phases of ground investigation (i.e. Geosyntec 2013/14 and Capita 2014), the following conclusions can be drawn:

- There is evidence of a degree of hydrocarbon impact – both TPH and PAH substances – to shallow Made ground soils at the northern / north-western end of the site, mostly around the old boiler house and fuel (diesel and heavy fuel oil) storage tanks (e.g. at WS14, WS18, WS30, BH9) and on the northern boundary (BH1, WS23). This is probably due to the known historical fuel spillages – diesel and/or heavy fuel oil, as listed in Section 4.7 – and potentially from further unrecorded fuel losses.
- Shallow perched groundwater may have been impacted to some extent by hydrocarbons – most notably at BH103 – but there is no indication that the Principal gravel aquifer has been affected.
- PAH impacts to shallow soils were also detected to the south-east of the Main Building (WS102), locally below in the undercroft (U21), and in the south-eastern part of the site (WS28). Some marginally elevated lead concentrations were recorded in isolated locations within the Made Ground (six samples exceeded the GAC). These lead and PAH impacts are most likely attributable to sporadic fragments of ash, slag or similar debris entrained within the Made Ground.
- Fragments of asbestos-containing material and/or loose asbestos fibres have been detected in shallow soils locally, including below the former boiler house (WS18, WS30, WS28), on the northern boundary (BH104, WS20, WS21) and in the south-eastern sector (BH5, BH109).
- Asbestos has also been detected – albeit at low concentrations – in a number of soil samples obtained from below the Main Building undercroft.

- The extent of possible mercury impacts to soils is, at this stage, uncertain. The laboratory data suggests some potentially elevated concentrations above 'background' levels but these are below applicable generic assessment criteria. Nevertheless given the anecdotal evidence of elemental mercury observed below the former boiler house and/or extant coffee ground combustion plant, there is a risk that 'globules' may exist and could be mobilised during site redevelopment.
- There is no indication of elevated concentrations of hazardous ground gases and concentrations of volatile vapours are relatively low.

## 11.5 Risk Assessment

11.5.1 With reference to the preliminary conceptual site model, the intrusive investigation has allowed the following assessment to be developed:

Area of Concern	Comments
TPH and PAH-impacted Made Ground / Fill materials	<ul style="list-style-type: none"> <li>• These impacts are such that some form of risk reduction is likely to be required in connection with the proposed development. This may comprise off-site disposal of any severely contaminated soils or excavation and ex-situ remediation to allow re-use within the site.</li> <li>• A cover layer of 'uncontaminated' imported topsoil is recommended in all areas of new private residential gardens or communal soft landscaping (including in the commercial development area) to protect end users and new planting.</li> <li>• It is possible that upgraded water supply pipes (for example Protecta-Line or a similar proprietary system) may be required for the new development, although this may be mitigated by any soil remediation works. The relevant water authority (Thames Water) should be consulted in this regard.</li> </ul>
Asbestos-impacted soils	<ul style="list-style-type: none"> <li>• Asbestos in the ground presents a potential risk to future construction (and demolition) workers, as well as to future site occupants. Allowance should be made – as far as reasonably practicable – for the affected soils to be screened (probably by hand) and the asbestos removed.</li> </ul>

Area of Concern	Comments
Mercury-impacted soils	<ul style="list-style-type: none"> <li>Further detailed investigations are recommended in the area reported to be potentially affected by elemental mercury. Allowance should be made for remedial work to address this matter (e.g. localised soil excavation or other potentially more extensive treatment). It is also noted that careful control of demolition works in this area will be vital to ensure that, should mercury be present, it is prevented from migrating vertically down into the gravel aquifer.</li> </ul>
Groundwater	<ul style="list-style-type: none"> <li>There is considered to be no evidence of significant or unacceptable chemical impacts to the Principal Lynch Hill Gravel aquifer. Furthermore the extensive thickness of low permeability London Clay deposits would prevent any downward contaminant migration into the sensitive Chalk aquifer. At this stage therefore, specific groundwater remediation is not anticipated to be necessary, although pockets of 'contaminated' perched water in the Made Ground may require removal and treatment during any soil remedial work.</li> </ul>
Ground gases and volatile vapours	<ul style="list-style-type: none"> <li>Ground gas protection measures are not expected to be required for the proposed development.</li> </ul>

## 11.6 Future Investigations

- 11.6.1 In addition to specific investigation of the northern sector as noted in the above table, it would be appropriate to carry out further site-wide investigations once manufacturing has ceased at the site and access to all areas – particularly below the existing building footprints - is more readily available.

## 12. Other Development Considerations

### 12.1 Waste Soils Characterisation

- 12.1.1 Any excavation works may potentially produce waste soils, for which appropriate waste management will be required. Off-site disposal of soil requires careful management and due consideration of appropriate legislation, guidance and Duty of Care responsibilities.
- 12.1.2 The chemical analysis data indicates that the majority of Made Ground soils would likely be classified as 'Non-Hazardous Waste', and the natural soils – outside the known hydrocarbon-impacted areas discussed above - as 'Inert', should off-site disposal be required. However any soils with significant hydrocarbon, asbestos or heavy metal (e.g. mercury) impacts will likely fall within the more onerous 'Hazardous' category.
- 12.1.3 It must be noted that if off-site disposal is required it is for the receiving landfill to make the final determination of waste classification. In the event that disposal of Hazardous Waste is required, the material must undergo Waste Acceptance Criteria (WAC) testing. WAC testing has a typical turnaround time of a minimum 2 weeks and allowance for this should be made in any development programme.
- 12.1.4 It would be prudent to implement a Materials Management Plan for the site in accordance with the CL:AIRE Development Industry Code of Practise (CoP) entitled 'The Definition of Waste' (September 2008). This CoP allows the risk-based re-use of materials within the site boundary without the need for exemptions and adoption of waste classifications.

### 12.2 Existing/Imported Fill

- 12.2.1 Any existing/imported fill will be subject to specific quality requirements. Allowance should be made for the testing of imported fill materials prior to emplacement to ensure suitability.

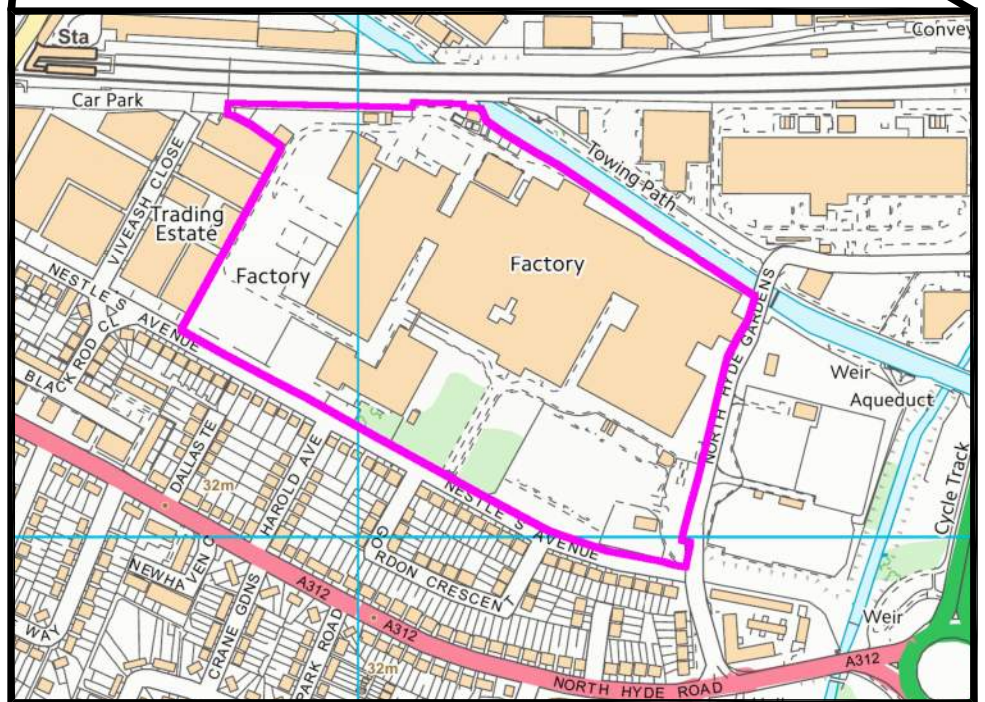
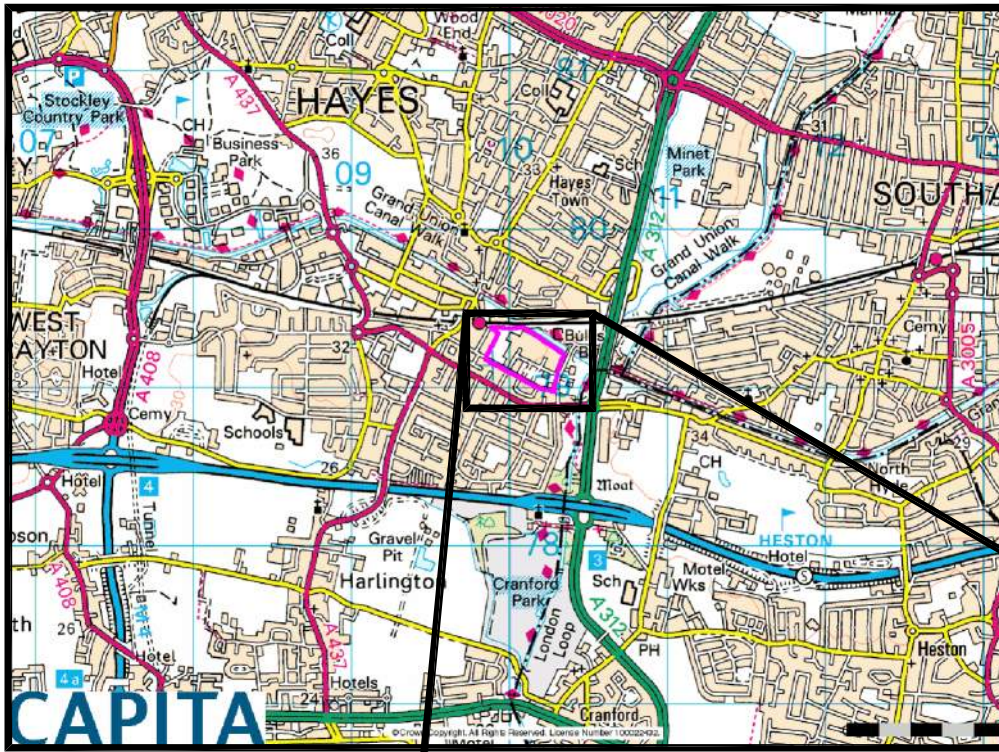
### 12.3 Health, Safety and Environment

- 12.3.1 Consideration should be given to the level of PPE made available to site operatives, taking cognisance of the content and findings of this and previous reports. All relevant information should be forwarded to contractors/personnel working in the subsurface.
- 12.3.2 All work on site should be conducted in accordance with appropriate Health and Safety guidance, with particular reference to HSG66 "Protection of Workers and the General Public during the Development of Contaminated Land".
- 12.3.3 Care should be taken to minimise the risk of potentially contaminative incidents occurring during redevelopment. Good working practices should be adopted during construction works in order to minimise the risk of contamination occurring as a result of spillage or leakage of fuels, oils or chemicals stored or used at the site during re-development.

- 12.3.4 Any such materials should be sited on an impervious base within a bund and should be adequately secured. In particular, care should be taken to prevent fuel, oils or other mobile contamination sources from entering any surface water drains at the site.
- 12.3.5 Throughout any redevelopment works, due regard should be given to potential detrimental effects on the surroundings including noise, vibration, odour and dust.
- 12.3.6 Any such materials should be sited on an impervious base within a bund and should be adequately secured. In particular, care should be taken to prevent fuel, oils or other mobile contamination sources from entering any surface water drains at the site.
- 12.3.7 Throughout any redevelopment works, due regard should be given to potential detrimental effects on the surroundings including noise, vibration, odour and dust.

# Appendix A - Drawings





Drawing status

**PRELIMINARY**

Client



Project

**PROJECT LIGHTNING, HAYES**

Drawing

**SITE LOCATION PLAN**

Scale @ A4

N.T.S.

Project No.

**CS/073681**

Drawing Identifier

075666 - CA- 0 - G00- DSP- SE- 502 - P00

Drawn

WFJ

Date

21/11/14

Checked

PWE

Office

WATFORD

BS1192:2007 / Avanti Compliant

project origin zone level file type role number revision

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Property and infrastructure

Consulting Civil, Structural and Geo-environmental Engineers

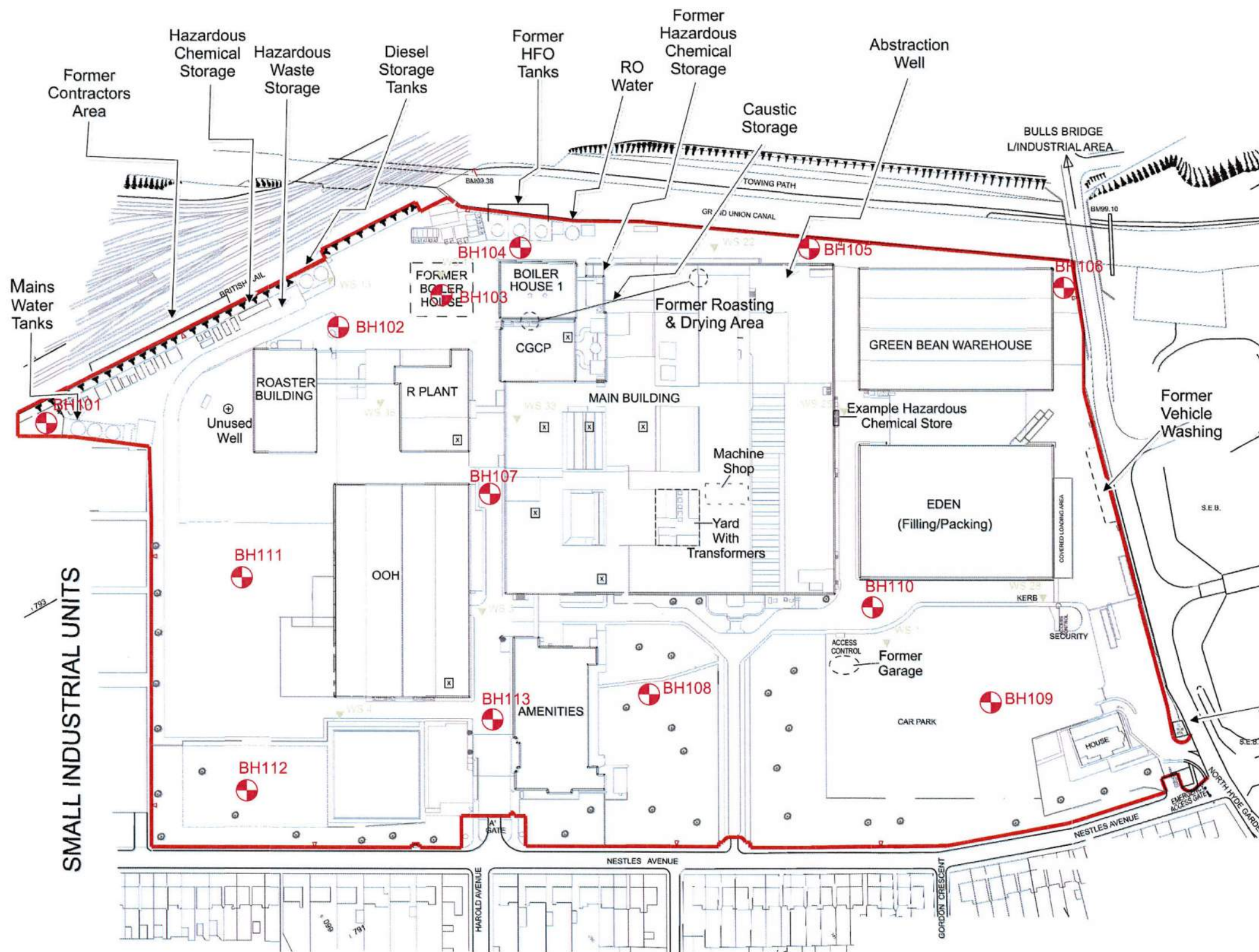
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**Legend**

- Geosyntec - Existing ground water monitoring well.
- Geosyntec - Existing shallow gas and ground water monitoring well.
- Geosyntec - Existing shallow soil sampling location.
- Capita - Proposed borehole location & reference number.

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**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**  
Refer to the relevant Construction (Design and Management) documentation where applicable.

It is assumed that all works on this drawing will be carried out by a competent contractor, working where appropriate to an approved method statement.

P02	20.11.14	WDJ	BOREHOLES 14 & 15 OMITTED, MINOR AMENDMENTS TO BH LOCATIONS, BH'S RE-NUMBERED.	PWE
P01	01.10.14	NDH	BOREHOLES 8 AND 9 AMENDED.	PWE

Rev	Date	By	Description	Rev check

Drawing status  
**PRELIMINARY**

Client

Project  
**PROJECT LIGHTNING**

Drawing  
**ENABLING WORKS  
SITE PLAN**

Scale @ A1	Drawn	Checked
1:1000	NDH	CJ
Project No.	Date	Office
CS/075666	Sept 2014	WATFORD

Drawing Identifier	BS1192:2007 / Avast	Compliant
project	origin zone level file type role number revision	
075666	-CA- 0 - G00 -DSP- SE -	001 - P02

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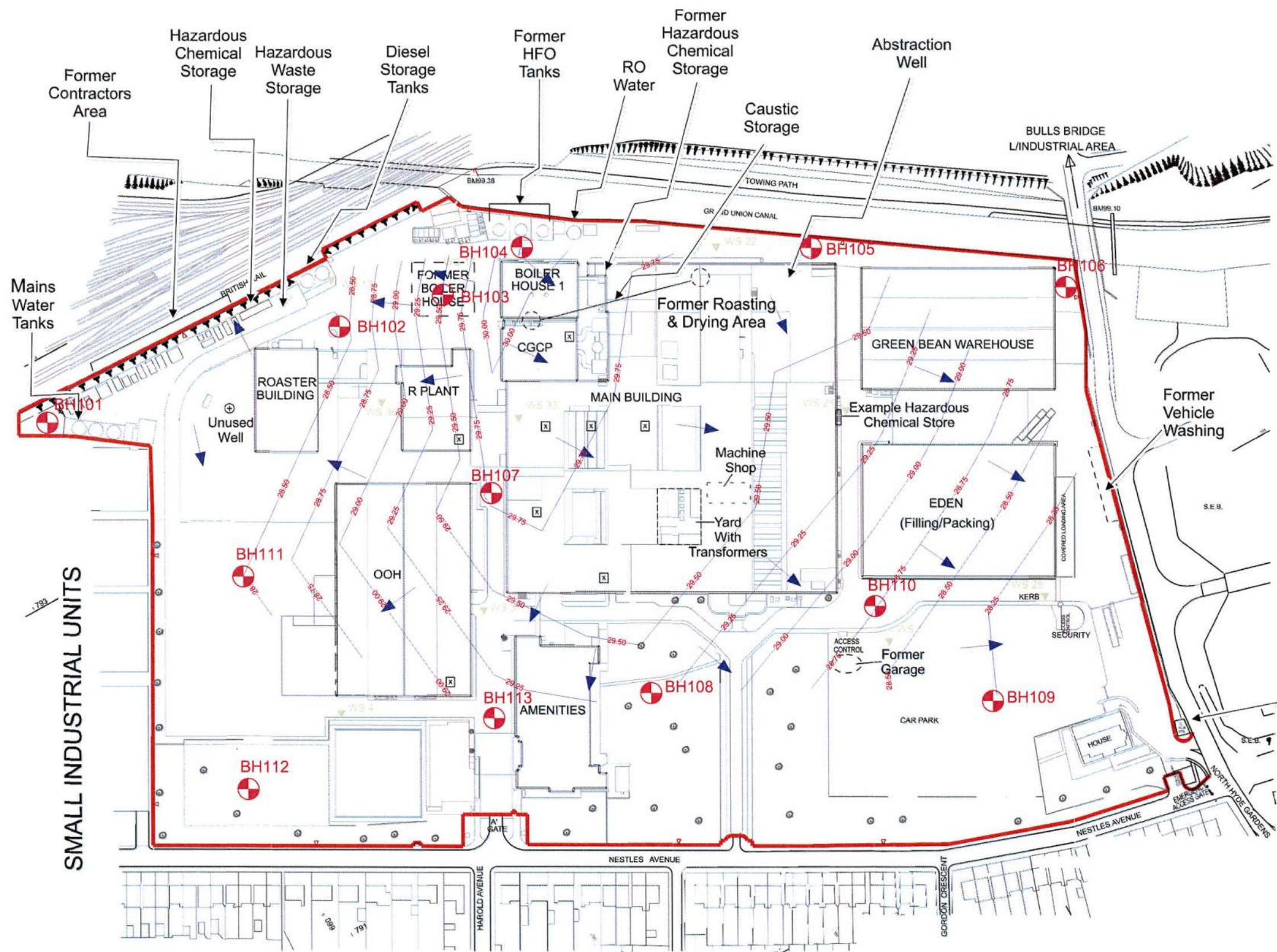
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**Legend**

- Geosyntec - Existing ground water monitoring well.
- Geosyntec - Existing shallow gas and ground water monitoring well.
- Geosyntec - Existing shallow soil sampling location.
- Capita - Proposed borehole location & reference number.
- GWL contours @ 250mm intervals & Indicative flow direction arrow.

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Refer to the relevant Construction (Design and Management) documentation where applicable.

It is assumed that all works on this drawing will be carried out by a competent contractor, working where appropriate to an approved method statement.

**ELECTRICAL STATION & PREMISES**

Rev	Date	By	Description	Rev' check

Drawing status  
**PRELIMINARY**

Client

Project  
**PROJECT LIGHTNING**

**INDICATIVE GROUND WATER FLOW PLOT**

Scale @ A1	Drawn	Checked
1:1000	WDJ	PE
Project No.	Date	Office
CS/075666	NOV 2014	WATFORD

Drawing Identifier	BS1192:2007 / Award Compliant
project	origin zone level file type role number revision
075666 -CA- 0 -G00 -DSP -SE-	002 - P00

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SMALL INDUSTRIAL UNITS

Substation

## Appendix B - Exploratory Hole Logs

# CAPITA

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WD24 4QP

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Fax : 01923 228 516  
www.capita.co.uk/property

Project : Project Lightning, Hayes

Job Number : CS075666

Client : SEGRO

Borehole Number

## BH101

Sheet 1 of 1

E Coord : -

N Coord : -

G.L. 31.27

Logged By : GEA

Date : 15/10/2014

Method : Dando 150

Checked By : PWE

### SAMPLING DATA

### GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.30	ES		31.17		0.10	TARMACADAM. (MADE GROUND).		
0.50	D		30.77		0.50	Firm dark red gravelly CLAY with gravel of concrete rubble and brick. (MADE GROUND).		
0.50 - 1.00	D							
0.65	ES							
1.00 - 1.40	D					Firm dark reddish grey silty CLAY with occasional brick gravel and charcoal. (MADE GROUND).		
1.50 - 1.90	D	50/250mm (5,9,10,15,18,7)	29.87		1.40	Dense to very dense dark brown sandy GRAVEL of subrounded flint. (LYNCH HILL GRAVEL).		
1.50 - 1.90	D							
2.20	ES							
2.50 - 3.00	D							
3.00 - 3.40	D	50/250mm (2,8,10,12,18,10)						
3.00 - 3.40	D							
4.00 - 4.50	D							
4.50 - 4.95	D	N=24 (4,8,3,6,7,8)						
4.50 - 4.95	D							
6.10 - 6.55	D	N=16 (1,2,3,3,5,5)	25.17		6.10	Firm brown weathered CLAY with silt. (LONDON CLAY).		
6.10 - 6.55	D							
6.30	ES		24.67		6.60	End of Borehole at 6.60 m		

#### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

#### REMARKS

50 mm HDPE standpipe installed to 6.0 m bgl. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

#### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
15/10/2014	4.50	2.80	10	4.50	6.10
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TC

Water Strike

Water Level

Oak House  
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Watford  
WD24 4QP

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Project : Project Lightning, Hayes

Job Number : CS075666

Client : SEGRO

E Coord : -

N Coord : -

G.L. 31.01

Date : 20/10/2014-  
21/10/2014

Method : Dando 150

Borehole Number

## BH102

Sheet 1 of 1

Logged By : GEA

Checked By : PWE

### SAMPLING DATA

### GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.30 - 0.50	D		30.71		0.30	CONCRETE. (MADE GROUND).		
0.30	ES							
0.50 - 1.00	D		30.41		0.60	Soft to firm dark reddish brown silty gravelly CLAY of flint and broken red brick with rare angular fragments. (MADE GROUND).		
0.75	ES							
1.00 - 1.50	D		30.01		1.00	Firm dark red sandy CLAY with occasional flint, brick and chalk gravel. (MADE GROUND).		
1.40	ES		29.61		1.40			
1.50 - 1.65	D	50/75mm (25,50)				Firm dark grey silty CLAY with occasional charcoal and ash. Rare coarse red brick and flint gravel. (MADE GROUND).		
1.50 - 1.65	D							
2.00 - 2.50	D							
2.10	ES							
3.00 - 3.38	D	54/225mm (6,10,16,18,20)						
3.00 - 3.38	D							
3.50 - 4.00	D							
4.50 - 4.95	D	N=50 (6,8,10,12,12,16)						
4.50 - 4.95	D							
5.00 - 5.50	D		26.01		5.00	Firm brown weathered silty CLAY. (LONDON CLAY).		
5.10	ES							
5.50 - 5.95	U	30 blows	25.51		5.50	Firm to stiff grey waxy silty CLAY. (LONDON CLAY).		
6.00	D		25.01		6.00	End of Borehole at 6.00 m		

#### SAMPLE/TEST KEY

D: Small Disturbed Sample  
B: Bulk Sample  
U: Undisturbed Sample (& Blows)  
S: Standard Penetration Test (split spoon)  
C: Standard Penetration Test (cone)  
N: Penetration Test 'N' Value  
Cu: Undrained Shear Strength kPa

#### REMARKS

50 mm HDPE standpipe installed to 5.0 mbgl. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

#### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
21/10/2014	4.00	2.60	10	4.00	5.00
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TC

▽ Water Strike

▼ Water Level

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Project : Project Lightning, Hayes			Borehole Number
Job Number : CS075666			<b>BH103</b>
Client : SEGRO			Sheet 1 of 1
E Coord : -	N Coord : -	G.L. 31.20	Logged By : GEA
Date : 17/10/2014-20/10/2014	Method : Dando 150		Checked By : PWE

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.60	ES		30.60		0.60	Reinforced CONCRETE with rebar and metal fragments. (MADE GROUND).		
			30.00		1.20	Medium dense dark grey clayey sandy GRAVEL. (MADE GROUND).		
						End of Borehole at 1.20 m		

### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

### REMARKS

Refusal on second layer of concrete foundations at 1.20 m. 50 mm HDPE standpipe installed to 1.2 mbgl. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
20/10/2014	1.00	0.50	10	-	-
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TC

Water Strike

Water Level

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Project : Project Lightning, Hayes			Borehole Number		
Job Number : CS075666			<b>BH104</b>		
Client : SEGRO			Sheet 1 of 1		
E Coord : -	N Coord : -	G.L. 31.00	Logged By : GEA		
Date : 15/10/2014-16/10/2014		Method : Dando 150	Checked By : PWE		

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.20 - 0.50	D		30.89		0.11	First layer of CONCRETE. (MADE GROUND).		
0.30	ES		30.75		0.25	Second layer of CONCRETE. (MADE GROUND).		
0.50 - 1.00	D							
0.90	ES		30.25		0.75	Loose dark grey very silty clayey GRAVEL of red brick and flint rubble. (MADE GROUND).		
1.00 - 1.50	D		30.00		1.00			
1.45	ES		29.60		1.40	Firm dark greyish brown silty sandy CLAY with frequent charcoal and occasional rounded flint gravel. (MADE GROUND).		
1.50 - 1.95	D	N=46 (5,8,10,10,12,14)						
1.50 - 1.95	D							
2.00 - 2.50	D		29.00		2.00	Soft orangish brown gravelly silty CLAY, possibly reworked brickearth.		
2.05	ES							
						Medium dense slightly clayey gravelly SAND, gravel is coarse subangular flint. (LYNCH HILL GRAVEL).		
3.00 - 3.45	D	N=44 (5,8,12,10,10,12)						
3.00 - 3.45	D							
						Very dense brown sandy GRAVEL of medium to coarse subrounded to angular flint. (LYNCH HILL GRAVEL).		
4.50 - 4.95	D	N=38 (6,8,8,10,10,10)						
4.50 - 4.95	D							
5.00 - 5.50	D		26.00		5.00	Firm brown weathered CLAY. (LONDON CLAY).		
5.10	ES							
5.50 - 5.95	U	25 blows	25.50		5.50	Stiff grey waxy CLAY. (LONDON CLAY).		
6.00	D		25.00		6.00	End of Borehole at 6.00 m		

### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

### REMARKS

50 mm HDPE standpipe installed to 5.0 mbgl. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
16/10/2014	4.00	2.50	10	4.00	5.00
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TC

▽ Water Strike

▼ Water Level





# CAPITA




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Project : Project Lightning, Hayes			Borehole Number <b>BH106</b>
Job Number : CS075666			
Client : SEGRO			Sheet 1 of 1
E Coord : -	N Coord : -	G.L. 30.34	Logged By : GEA
Date : 16/10/2014	Method : Dando 150		Checked By : PWE

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
			29.94		0.40	CONCRETE with steel reinforcement. (MADE GROUND).		
			29.74		0.60	Medium dense slightly clayey sandy GRAVEL of fine to coarse brick and concrete with occasional subangular flint. (MADE GROUND).  End of Borehole at 0.60 m		

### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

### REMARKS

Borehole abandoned due to second layer of concrete at 0.60 m

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
No Groundwater			Encountered		
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TC

 Water Strike

 Water Level

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Project : Project Lightning, Hayes

Job Number : CS075666

Client : SEGRO

E Coord : -

N Coord : -

G.L. 31.29

Date : 16/10/2014-  
17/10/2014

Method : Dando 150

Borehole Number

**BH107**

Sheet 1 of 1

Logged By : GEA

Checked By : PWE

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.30 - 0.50	D		31.19		0.10	First layer of CONCRETE. (MADE GROUND).		
0.35	ES		31.01		0.28	Second layer of CONCRETE. (MADE GROUND).		
0.50 - 1.00	D							
0.80	ES							
1.00 - 1.40	D					Soft dark brown silty gravelly CLAY with sandstone, brick and flint gravel and rare glass, ash and charcoal. Possibly reworked brickearth at base of unit. (MADE GROUND).		
1.35	ES		29.89		1.40			
1.50 - 1.95	D	N=48 (6,8,10,12,12,14)				Dense orange-brown sandy flint GRAVEL. (LYNCH HILL GRAVEL)		
2.00 - 2.50	D							
3.00 - 3.30	D	50/150mm (5,10,20,30)						
3.50	ES							
3.50 - 4.00	D							
4.50 - 4.95	D	N=30 (5,6,9,8,6,7)						
4.50 - 4.95	D							
4.90 - 5.10	D		26.39		4.90	Firm light greyish brown silty CLAY. (LONDON CLAY)		
5.10 - 5.40	D		26.19		5.10	Stiff dark grey waxy CLAY. (LONDON CLAY).		
5.30	ES							
5.40 - 5.85	U	35 blows						
5.90	D		25.39		5.90	End of Borehole at 5.90 m		

### SAMPLE/TEST KEY

D: Small Disturbed Sample  
B: Bulk Sample  
U: Undisturbed Sample (& Blows)  
S: Standard Penetration Test (split spoon)  
C: Standard Penetration Test (cone)  
N: Penetration Test 'N' Value  
Cu: Undrained Shear Strength kPa

### REMARKS

50 mm HDPE standpipe installed to 5.0 mbgl. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
17/10/2014	4.00	2.50	10	4.00	5.10
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TC

▽ Water Strike

▼ Water Level

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Project : Project Lightning, Hayes			Borehole Number
Job Number : CS075666			<b>BH108</b>
Client : SEGRO			Sheet 1 of 1
E Coord : -	N Coord : -	G.L. 30.90	Logged By : GEA
Date : 06/10/2014	Method : Competitor		Checked By : PWE

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.00 - 0.50	B					Grass over loose dark brown sandy gravelly TOPSOIL with abundant rootlets.		
			30.55		0.35			
			30.30		0.60	Loose becoming medium dense brown silty gravelly SAND with frequent subangular flint gravel and rare charcoal. Reworked brickearth towards base of unit. (MADE GROUND).		
1.20 - 1.55		50/200mm (3,7,15,18,17)						
1.55	D		29.65		1.25	Medium dense light brown sandy gravelly SILT with frequent subangular medium to coarse flint gravel. (BRICKEARTH).		
2.00 - 2.28		50/175mm (9,16,22,20,8)						
2.80 - 3.00		50/100mm (17,8,35,15)						
2.80	D		28.10		2.80	Dense light grey becoming orangish brown sandy GRAVEL of subangular to angular flint with occasional subangular sandstone clasts. (LYNCH HILL GRAVEL). At 1.65 m colour change due to absence of friable pink sandstone clasts.		
						End of Borehole at 2.80 m		

### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

### REMARKS

50 mm HDPE standpipe installed to 2.1 mbgl. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
06/10/2014	2.60	2.10	45	-	-
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					CL

▽ Water Strike

▼ Water Level

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Project : Project Lightning, Hayes

Job Number : CS075666

Client : SEGRO

E Coord : -

N Coord : -

G.L. 30.90

Date : 06/10/2014

Method : Competitor

Borehole Number

**BH108A**

Sheet 1 of 1

Logged By : GEA

Checked By : PWE

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.25	D		30.65		0.25	Grass over loose dark brown gravelly TOPSOIL with abundant rootlets.		
			30.45		0.45	Medium dense light brown sandy gravelly TOPSOIL with rare brick fragments and rounded chalk clasts.		
						End of Borehole at 0.45 m		

### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

### REMARKS

Hole abandoned on presumed concrete obstruction at 0.45 m.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
	No Groundwater		Encountered		
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					CL

Water Strike

Water Level

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Project : Project Lightning, Hayes			Borehole Number		
Job Number : CS075666			BH109		
Client : SEGRO			Sheet 1 of 1		
E Coord : -	N Coord : -	G.L. 29.82	Logged By : GEA		
Date : 21/10/2014		Method : Dando 150	Checked By : PWE		

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.00 - 0.50 0.15	D ES		29.75		0.07	TARMACADAM. (MADE GROUND).		
0.50 - 1.00 0.65	D ES					Loose to medium dense clayey GRAVEL of brick, concrete and stone. (MADE GROUND)		
1.00 - 1.50	B		28.82		1.00	Firm brown silty sandy CLAY. (BRICKEARTH)		
1.40 1.50 - 1.65 1.50 - 1.65	ES D	50/75mm (25,50)	28.42		1.40	Dense orange-brown sandy flint GRAVEL. (LYNCH HILL GRAVEL)		
3.00 - 3.45 3.00 - 3.45 3.00	D ES	N=44 (5,10,10,10,12,12)						
3.50 - 4.00 3.60	B ES		26.32		3.50	Firm grey-brown silty CLAY. (LONDON CLAY FORMATION)		
4.00 - 4.45 4.00 - 4.45	D	N=15 (2,2,2,3,5,5)	25.32		4.50	End of Borehole at 4.50 m		

### SAMPLE/TEST KEY

D: Small Disturbed Sample  
B: Bulk Sample  
U: Undisturbed Sample (& Blows)  
S: Standard Penetration Test (split spoon)  
C: Standard Penetration Test (cone)  
N: Penetration Test 'N' Value  
Cu: Undrained Shear Strength kPa

Water Strike  
 Water Level

### REMARKS

50mm diameter HDPE standpipe installed to 3.50 m. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
21/10/2014	1.50	1.40	10	1.50	3.50
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TC

# CAPITA

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Project : Project Lightning, Hayes			Borehole Number
Job Number : CS075666			<b>BH109A</b>
Client : SEGRO			Sheet 1 of 1
E Coord : -	N Coord : -	G.L. 29.82	Logged By : GEA
Date : 16/10/2014	Method : Dando 150		Checked By : PWE

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.40	ES		29.70		0.12	TARMACADAM. (MADE GROUND).		
			29.42		0.40	Dense redish brown clayey GRAVEL of bricks, concrete and broken tarmacadam. (MADE GROUND).		
			29.22		0.60	Dense yellowish brown silty sandy GRAVEL of rubble, bricks, sandstone, concrete, tile fragments with occasional ash and charcoal. (MADE GROUND). End of Borehole at 0.60 m		

### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

### REMARKS

Hole abandoned due to refusal on suspected concrete obstruction.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
	No Groundwater			Encountered	
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TC

Water Strike

Water Level





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Project : Project Lightning, Hayes

Job Number : CS075666

Client : SEGRO

E Coord : -

N Coord : -

G.L. 30.98

Date : 13/10/2014-  
15/10/2014

Method : Comacchio Geo 205

Borehole Number

## BH111

Sheet 1 of 1

Logged By : GEA

Checked By : PWE

### SAMPLING DATA

### GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.40	D		30.78		0.20	CONCRETE.		
			30.48		0.50	Dense greyish brown slightly clayey sandy GRAVEL of fine to medium brick and stone of mixed lithologies with occasional concrete cobbles. (MADE GROUND)		
1.00	D		30.08		0.90			
1.10 - 1.60	B		29.88		1.10	Soft to firm brown slightly sandy gravelly CLAY. Gravel of subangular fine to coarse flint with occasional brick fragments. (MADE GROUND).		
1.50 - 1.88		50/225mm (4,10,14,15,21)				Medium dense brown slightly gravelly SAND. (LYNCH HILL GRAVEL).		
3.00 - 3.34		50/190mm (4,6,13,23,14)				Very dense brown very sandy flint GRAVEL which is slightly clayey at the start of the unit. (LYNCH HILL GRAVEL). From 1.30 to 1.40 m Coarse sandy band. At 1.80 m occasional light red granular sandstone clasts. After 3.00 m frequent subrounded flint cobbles	▽	
4.00	D							
4.40	D							
4.50 - 4.95		N=29 (5,10,7,7,7,8)				Colour change from 4.30 to 4.50 m to dark brown with very faint hydrocarbon odour.		
			25.28		5.70	End of Borehole at 5.70 m		

#### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

#### REMARKS

50mm diameter HDPE standpipe installed to 4.20 m. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

#### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
13/10/2014	2.50				
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					JY

▽ Water Strike

▼ Water Level

# CAPITA

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Project : Project Lightning, Hayes

Job Number : CS075666

Client : SEGRO

E Coord : -

N Coord : -

G.L. 31.37

Date : 07/10/2014-  
08/10/2014

Method : Comacchio Geo 205

Borehole Number

**BH112**

Sheet 1 of 1

Logged By : GEA

Checked By : PWE

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.65	D		31.07		0.30	Grass over loose dark brown TOPSOIL with frequent flint gravel and occasional brick and chalk.		
			30.97		0.40			
			30.77		0.60			
			30.57		0.80			
1.20 - 1.41	B	50/90mm (12,13,40,10)				Loose very dark brown clayey sandy silty GRAVEL of flint with abundant broken red bricks. (MADE GROUND).		
1.20 - 2.15	B					Soft to firm light yellowish brown possibly reworked sandy gravelly SILT with occasional flint gravel. (BRICKEARTH).		
1.75	D							
2.00 - 2.09		50/40mm (25,50)				Firm orangish brown gravelly CLAY with frequent subrounded pebbles and occasional charcoal. (BRICKEARTH).		
3.50 - 3.68		50/30mm (10,15,50)				Dense orangish brown sandy GRAVEL of predominantly subangular occasionally subrounded fine to coarse flint with rare cobbles. (LYNCH HILL GRAVEL). After 1.45 m gravel becomes fine to medium with increased sand content.	▽	
			26.37		5.00	End of Borehole at 5.00 m		

### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

### REMARKS

50mm diameter HDPE standpipe installed to 2.20 m. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
07/10/2014	2.60				
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TP

▽ Water Strike

▼ Water Level

# CAPITA

Oak House  
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Tel : 01923 817 537  
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Project : Project Lightning, Hayes

Job Number : CS075666

Client : SEGRO

E Coord : -

N Coord : -

G.L. 31.08

Date : 08/10/2014

Method : Comacchio Geo 205

Borehole Number

**BH113**

Sheet 1 of 1

Logged By : GEA

Checked By : PWE

## SAMPLING DATA

## GROUND STRATA

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.30	D		31.03		0.05	TARMACADAM. (MADE GROUND).		
			30.83		0.25	CONCRETE. (MADE GROUND).		
			30.68		0.40	Medium dense dark greyish black sandy GRAVEL with frequent subangular cobbles of granite and occasional flint gravel. (MADE GROUND).		
1.20 - 1.52		50/245mm (25,6,8,16,20)	30.28		0.80			
1.40	D		29.58		1.50	Loose to medium dense sandy GRAVEL and Cobbles of red and yellow brick hardcore with occasional fine to medium flint gravel. (MADE GROUND).	▼	
2.70 - 3.10		50/250mm (8,12,14,16,15,5)				Soft brown silty CLAY. Upper section appears slightly reworked with rare gravel of ash, charcoal and slag. Occasional flint and chalk at base of unit. (BRICKEARTH).	▽	
5.00	D		26.48		4.60	Stiff dark brown silty CLAY with brown iron staining. (LONDON CLAY).		
5.20 - 5.65	U		26.08		5.00	Stiff greyish brown waxy CLAY. (LONDON CLAY).		
			25.38		5.70	End of Borehole at 5.70 m		

### SAMPLE/TEST KEY

- D: Small Disturbed Sample
- B: Bulk Sample
- U: Undisturbed Sample (& Blows)
- S: Standard Penetration Test (split spoon)
- C: Standard Penetration Test (cone)
- N: Penetration Test 'N' Value
- Cu: Undrained Shear Strength kPa

### REMARKS

50mm diameter HDPE standpipe installed to 4.00 m. Finished with bung, gas valve and flush steel cover.

Scale = 1:50

### Boring Progress & Water Observation Depths (m)

Date	Strike	Level	Minutes	Casing	Sealed
08/10/2014	2.00	1.50	10	0.00	-
Chiselling			Water Added		Driller
From	To	Hours	From	To	
					TP

▽ Water Strike

▼ Water Level

# Appendix C - Laboratory Chemical Analysis Results



**George Andrew**  
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## **Analytical Report Number : 14-61328**

<b>Project / Site name:</b>	Project Lightning	<b>Samples received on:</b>	10/10/2014
<b>Your job number:</b>	CS075666	<b>Samples instructed on:</b>	14/10/2014
<b>Your order number:</b>	ZLON	<b>Analysis completed by:</b>	22/10/2014
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	22/10/2014
<b>Samples Analysed:</b>	3 soil samples		

**Signed:** CC Stone

Dr Claire Stone  
Quality Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:** Rexona Rahman

Rexona Rahman  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

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

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

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Analytical Report Number: 14-61328  
 Project / Site name: Project Lightning  
 Your Order No: ZLON

Lab Sample Number	381412	381413	381414			
Sample Reference	BH108	BH112	BH113			
Sample Number	None Supplied	None Supplied	None Supplied			
Depth (m)	0.25	0.65	1.40			
Date Sampled	07/10/2014	09/10/2014	10/10/2014			
Time Taken	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	5.2	15	14
Total mass of sample received	kg	0.001	NONE	0.48	0.48	0.51

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected

#### General Inorganics

pH	pH Units	N/A	MCERTS	8.5	8.4	8.1
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.021	0.030	0.14
Water Soluble Sulphate as SO <sub>4</sub> (2:1)	mg/kg	2.5	MCERTS	21	30	140
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.011	0.015	0.070
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.8	0.2	< 0.1

#### Speciated PAHs

	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10
Phenanthrene	mg/kg	0.1	MCERTS	0.30	< 0.10	< 0.10
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10
Fluoranthene	mg/kg	0.1	MCERTS	0.53	< 0.10	< 0.10
Pyrene	mg/kg	0.1	MCERTS	0.59	< 0.10	< 0.10
Benzo(a)anthracene	mg/kg	0.1	MCERTS	0.43	< 0.10	< 0.10
Chrysene	mg/kg	0.05	MCERTS	0.34	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	0.40	< 0.10	< 0.10
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	0.30	< 0.10	< 0.10
Benzo(a)pyrene	mg/kg	0.1	MCERTS	0.34	< 0.10	< 0.10
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	0.27	< 0.10	< 0.10
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.34	< 0.05	< 0.05

#### Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	3.84	< 1.60	< 1.60

#### Heavy Metals / Metalloids

	mg/kg	1	MCERTS	12	13	16
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	13	16
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	0.6	1.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	42	42
Copper (aqua regia extractable)	mg/kg	1	MCERTS	35	32	26
Lead (aqua regia extractable)	mg/kg	1	MCERTS	94	31	15
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	34	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	23	38	39
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	47	73	72
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	91	64	54

Analytical Report Number: 14-61328  
 Project / Site name: Project Lightning  
 Your Order No: ZLON

Lab Sample Number	381412	381413	381414		
Sample Reference	BH108	BH112	BH113		
Sample Number	None Supplied	None Supplied	None Supplied		
Depth (m)	0.25	0.65	1.40		
Date Sampled	07/10/2014	09/10/2014	10/10/2014		
Time Taken	None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

#### Monoaromatics

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		

#### Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0		
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0		
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	8.6		
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	< 10	< 10	< 10		

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0		
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10		
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	< 10		
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	< 10	< 10	< 10		



4041



Environmental Science

**Analytical Report Number : 14-61328**

**Project / Site name: Project Lightning**

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

of a sample is calculated as the % weight of the stones not passing a 2 mm sieve. Results are not corrected for stone content.

Stone content

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
381412	BH108	None Supplied	0.25	Light brown sandy topsoil with gravel and vegetation.
381413	BH112	None Supplied	0.65	Light brown clay and sand with gravel.
381414	BH113	None Supplied	1.40	Light brown clay with gravel.





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Environmental Science

Analytical Report Number : 14-61328

Project / Site name: Project Lightning

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight. Sample results are not corrected for the stone content of the sample.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by extraction with water followed by ICP-OES. Results reported corrected for extraction ratio (soil equivalent) as g/l and mg/kg; and upon the 2:1 leachate (n/l)	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
TPHCWG (Soil)	Determination of pentane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.



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## **Analytical Report Number : 14-61928**

<b>Project / Site name:</b>	Project Lightning	<b>Samples received on:</b>	22/10/2014
<b>Your job number:</b>	CS075666	<b>Samples instructed on:</b>	24/10/2014
<b>Your order number:</b>	ZLON	<b>Analysis completed by:</b>	04/11/2014
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	04/11/2014
<b>Samples Analysed:</b>	15 soil samples		

**Signed:** 

Dr Claire Stone  
Quality Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:** 

Thurstan Plummer  
Organics Technical Manager  
**For & on behalf of i2 Analytical Ltd.**

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

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

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

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Environmental Science

Analytical Report Number: 14-61928

Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	384922	384923	384924	384925	384926			
Sample Reference	BH101	BH101	BH102	BH102	BH103			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	0.65	2.20	0.30	1.40	0.65			
Date Sampled	15/10/2014	15/10/2014	20/10/2014	20/10/2014	20/10/2014			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	15	6.7	11	15	12
Total mass of sample received	kg	0.001	NONE	0.56	0.54	0.46	0.48	0.55

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected

**General Inorganics**

pH	pH Units	N/A	MCERTS	8.5	8.5	8.2	8.3	9.8
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.051	0.031	2.2	1.2	0.25
Water Soluble Sulphate as SO <sub>4</sub> (2:1)	mg/kg	2.5	MCERTS	51	31	2200	1200	250
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.026	0.016	1.1	0.59	0.12
Total Organic Carbon (TOC)	%	0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.8	0.4

**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.20	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	0.44	< 0.10	< 0.10
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	0.59	< 0.10	< 0.10
Pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	0.50	< 0.10	< 0.10
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	0.40	< 0.10	< 0.10
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.45	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	0.41	< 0.10	< 0.10
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	0.32	< 0.10	< 0.10
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	0.41	< 0.10	< 0.10
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

**Total PAH**

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	< 1.60	< 1.60	3.72	< 1.60	< 1.60
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	29	11	32	22	12
Boron (water soluble)	mg/kg	0.2	MCERTS	1.1	0.6	1.8	2.3	1.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.3	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	33	13	27	23	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	51	8.0	150	67	61
Lead (aqua regia extractable)	mg/kg	1	MCERTS	68	11	540	260	72
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	1.1	2.1	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	41	13	29	27	39
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	59	24	47	43	34
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	72	20	140	91	46

Analytical Report Number: 14-61928  
 Project / Site name: Project Lightning  
 Your Order No: ZLON

Lab Sample Number	384922	384923	384924	384925	384926
Sample Reference	BH101	BH101	BH102	BH102	BH103
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.65	2.20	0.30	1.40	0.65
Date Sampled	15/10/2014	15/10/2014	20/10/2014	20/10/2014	20/10/2014
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

#### Monoaromatics

Compound	Units	Limit of detection	Accreditation Status	384922	384923	384924	384925	384926
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

#### Petroleum Hydrocarbons

Parameter	Units	Limit of detection	Accreditation Status	384922	384923	384924	384925	384926
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	6.6	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	15	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	48	< 8.0	< 8.0
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	< 10	< 10	69	< 10	< 10

Parameter	Units	Limit of detection	Accreditation Status	384922	384923	384924	384925	384926
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	67	< 10	< 10
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	< 10	< 10	67	< 10	< 10



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Environmental Science

Analytical Report Number: 14-61928

Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	384927	384928	384929	384930	384931			
Sample Reference	BH104	BH104	BH104	BH107	BH107			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	0.30	0.90	1.45	0.80	3.50			
Date Sampled	16/10/2014	16/10/2014	16/10/2014	17/10/2014	17/10/2014			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	12	17	17	18	0.69
Total mass of sample received	kg	0.001	NONE	0.53	0.52	0.55	0.52	0.61

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Amosite- Loose fibres, Chrysotile- Insulation lagging	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected	Not-detected	Not-detected

**General Inorganics**

pH	pH Units	N/A	MCERTS	9.9	8.8	9.2	8.6	8.7
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.37	0.17	0.36	0.27	0.020
Water Soluble Sulphate as SO <sub>4</sub> (2:1)	mg/kg	2.5	MCERTS	370	170	360	270	20
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.19	0.084	0.18	0.13	0.010
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.1	0.5	0.4	0.5	< 0.1

**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	0.31	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.1	MCERTS	0.29	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	0.1	MCERTS	0.30	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	mg/kg	0.1	MCERTS	0.24	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	mg/kg	0.1	MCERTS	6.8	< 0.10	0.55	0.97	< 0.10
Anthracene	mg/kg	0.1	MCERTS	1.3	< 0.10	0.11	0.24	< 0.10
Fluoranthene	mg/kg	0.1	MCERTS	9.1	< 0.10	0.70	2.3	< 0.10
Pyrene	mg/kg	0.1	MCERTS	6.9	< 0.10	0.57	1.9	< 0.10
Benzo(a)anthracene	mg/kg	0.1	MCERTS	3.3	< 0.10	0.24	1.2	< 0.10
Chrysene	mg/kg	0.05	MCERTS	3.5	< 0.05	0.25	1.2	< 0.05
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	3.1	< 0.10	0.20	1.2	< 0.10
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	1.6	< 0.10	0.12	0.69	< 0.10
Benzo(a)pyrene	mg/kg	0.1	MCERTS	2.5	< 0.10	0.15	1.1	< 0.10
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	1.2	< 0.10	< 0.10	0.48	< 0.10
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.15	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.6	< 0.05	< 0.05	0.62	< 0.05

**Total PAH**

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	42.2	< 1.60	2.89	11.8	< 1.60
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13	7.1	9.3	13	8.8
Boron (water soluble)	mg/kg	0.2	MCERTS	1.9	1.7	2.2	1.2	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	23	24	24	12
Copper (aqua regia extractable)	mg/kg	1	MCERTS	42	33	28	55	9.4
Lead (aqua regia extractable)	mg/kg	1	MCERTS	44	100	33	200	6.8
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	9.5	44	19	1.4	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20	21	21	24	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	35	36	36	42	21
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	80	56	59	84	450



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Environmental Science

Analytical Report Number: 14-61928

Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number				384927	384928	384929	384930	384931
Sample Reference				BH104	BH104	BH104	BH107	BH107
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.90	1.45	0.80	3.50
Date Sampled				16/10/2014	16/10/2014	16/10/2014	17/10/2014	17/10/2014
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
<b>Monoaromatics</b>								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

**Petroleum Hydrocarbons**

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	5.2	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	33	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	140	< 8.0	< 8.0	< 8.0	< 8.0
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	180	< 10	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	6.1	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	40	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	140	< 10	< 10	24	< 10
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	180	< 10	< 10	24	< 10

**Analytical Report Number: 14-61928**  
**Project / Site name: Project Lightning**  
**Your Order No: ZLON**

Lab Sample Number	384932	384933	384934	384935	384936			
Sample Reference	BH109	BH109	BH111	BH111	BH111			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	0.65	1.40	0.46	4.00	4.40			
Date Sampled	21/10/2014	21/10/2014	13/10/2014	13/10/2014	13/10/2014			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	12	13	9.9	4.1	4.0
Total mass of sample received	kg	0.001	NONE	0.47	0.51	0.56	0.61	0.59

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile - Loose fibres	Chrysotile - Loose fibres	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Detected	Not-detected	Not-detected	Not-detected

#### General Inorganics

pH	pH Units	N/A	MCERTS	8.0	8.1	11.2	9.6	9.2
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.17	0.063	0.21	0.020	0.021
Water Soluble Sulphate as SO <sub>4</sub> (2:1)	mg/kg	2.5	MCERTS	170	63	210	20	21
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.086	0.032	0.11	0.010	0.010
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.8	0.3	0.4	< 0.1	< 0.1

#### Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	mg/kg	0.1	MCERTS	0.94	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	mg/kg	0.1	MCERTS	0.21	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	mg/kg	0.1	MCERTS	2.9	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	mg/kg	0.1	MCERTS	2.7	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(a)anthracene	mg/kg	0.1	MCERTS	1.5	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	mg/kg	0.05	MCERTS	1.4	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	1.2	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	1.2	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(a)pyrene	mg/kg	0.1	MCERTS	1.5	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	0.60	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.84	< 0.05	< 0.05	< 0.05	< 0.05

#### Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	15.0	< 1.60	< 1.60	< 1.60	< 1.60
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#### Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	12	11	7.8	7.4
Boron (water soluble)	mg/kg	0.2	MCERTS	0.8	1.1	1.4	0.3	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	41	28	15	14
Copper (aqua regia extractable)	mg/kg	1	MCERTS	53	22	23	7.3	10
Lead (aqua regia extractable)	mg/kg	1	MCERTS	420	23	24	4.2	4.1
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22	29	22	18	26
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	36	56	31	17	18
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	250	62	46	26	21

Analytical Report Number: 14-61928  
 Project / Site name: Project Lightning  
 Your Order No: ZLON

Lab Sample Number	384932	384933	384934	384935	384936			
Sample Reference	BH109	BH109	BH111	BH111	BH111			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	0.65	1.40	0.46	4.00	4.40			
Date Sampled	21/10/2014	21/10/2014	13/10/2014	13/10/2014	13/10/2014			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
<b>Monoaromatics</b>								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

**Petroleum Hydrocarbons**

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	11	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	44	< 10	< 10	< 10	< 10
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	55	< 10	< 10	< 10	< 10





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**Analytical Report Number : 14-61928****Project / Site name: Project Lightning**

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
384922	BH101	None Supplied	0.65	Brown clay and sand.
384923	BH101	None Supplied	2.20	Light brown gravelly sand.
384924	BH102	None Supplied	0.30	Brown sandy topsoil with gravel.
384925	BH102	None Supplied	1.40	Brown topsoil and clay with gravel.
384926	BH103	None Supplied	0.65	Brown gravelly sand.
384927	BH104	None Supplied	0.30	Brown topsoil and clay.
384928	BH104	None Supplied	0.90	Brown topsoil and clay.
384929	BH104	None Supplied	1.45	Brown topsoil and clay.
384930	BH107	None Supplied	0.80	Brown topsoil and clay.
384931	BH107	None Supplied	3.50	Light brown sand with gravel.
384932	BH109	None Supplied	0.65	Brown topsoil and clay with gravel and brick.
384933	BH109	None Supplied	1.40	Brown clay and sand.
384934	BH111	None Supplied	0.46	Brown gravelly sand.
384935	BH111	None Supplied	4.00	Light brown gravelly sand.
384936	BH111	None Supplied	4.40	Light brown gravelly sand.



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Analytical Report Number : 14-61928

Project / Site name: Project Lightning

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight. Sample	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by extraction with water followed by ICP-OES. Results reported corrected for extraction ratio (soil equivalent) as g/l and mg/kg; and upon the 2:1	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
TPHCWG (Soil)	Determination of pentane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



**George Andrew**

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## **Analytical Report Number : 14-62379**

Replaces Analytical Report Number : 14-62379, issue no. 1

<b>Project / Site name:</b>	Project Lightning	<b>Samples received on:</b>	30/10/2014
<b>Your job number:</b>	CS075666	<b>Samples instructed on:</b>	31/10/2014
<b>Your order number:</b>	ZLON	<b>Analysis completed by:</b>	18/11/2014
<b>Report Issue Number:</b>	2	<b>Report issued on:</b>	18/11/2014
<b>Samples Analysed:</b>	17 water samples		

**Signed:** 

Dr Claire Stone  
Quality Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:** 

Rexona Rahman  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

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

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

Excel copies of reports are only valid when accompanied by this PDF certificate.



Analytical Report Number: 14-62379  
Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387748	387749	387750	387751	387752
Sample Reference	BH109	BH6	BH7	BH107	BH113
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.56	1.59	1.49	1.50	1.96
Date Sampled	29/10/2014	29/10/2014	29/10/2014	29/10/2014	29/10/2014
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

#### General Inorganics

	pH Units	N/A	ISO 17025	7.2	7.0	7.9	7.7	7.3
pH								
Sulphate as SO <sub>4</sub>	µg/l	45	ISO 17025	47000	64800	174000	22000	265000
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	7.16	2.93	8.26	7.61	3.02

#### Speciated PAHs

	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.16	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.05	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.10	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.03	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.05	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.04	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

#### Total PAH

Total EPA-16 PAHs	µg/l	0.2	ISO 17025	< 0.20	< 0.20	< 0.20	0.43	< 0.20

#### Heavy Metals / Metalloids

	µg/l	0.15	ISO 17025	1.49	0.60	4.91	4.57	0.24
Arsenic (dissolved)	µg/l	10	ISO 17025	160	160	380	84	270
Boron (dissolved)	µg/l	0.02	ISO 17025	0.02	0.04	< 0.02	< 0.02	0.03
Cadmium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	5.2	0.3	0.2
Chromium (dissolved)	µg/l	0.5	ISO 17025	5.8	6.2	21	8.3	6.2
Copper (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	0.8	< 0.2	< 0.2
Lead (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Mercury (dissolved)	µg/l	0.5	ISO 17025	6.1	3.9	1.7	3.8	6.5
Nickel (dissolved)	µg/l	0.6	ISO 17025	1.9	3.6	1.7	< 0.6	8.5
Selenium (dissolved)	µg/l	0.5	ISO 17025	2.7	1.1	3.9	2.0	0.7
Zinc (dissolved)								



Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387748	387749	387750	387751	387752			
Sample Reference	BH109	BH6	BH7	BH107	BH113			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	1.56	1.59	1.49	1.50	1.96			
Date Sampled	29/10/2014	29/10/2014	29/10/2014	29/10/2014	29/10/2014			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

**Monoaromatics**

Parameter	Units	Limit of detection	Accreditation Status	387748	387749	387750	387751	387752
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

**Petroleum Hydrocarbons**

Parameter	Units	Limit of detection	Accreditation Status	387748	387749	387750	387751	387752
TPH-CWG - Aliphatic >C5 - C6	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C6 - C8	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C8 - C10	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
<b>TPH-CWG - Aliphatic (C5 - C35)</b>	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

Parameter	Units	Limit of detection	Accreditation Status	387748	387749	387750	387751	387752
TPH-CWG - Aromatic >C5 - C7	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C7 - C8	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C8 - C10	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
<b>TPH-CWG - Aromatic (C5 - C35)</b>	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10



Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387748	387749	387750	387751	387752
Sample Reference	BH109	BH6	BH7	BH107	BH113
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.56	1.59	1.49	1.50	1.96
Date Sampled	29/10/2014	29/10/2014	29/10/2014	29/10/2014	29/10/2014
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

**VOCs**

Analytical Parameter	Units	Limit of detection	Accreditation Status	387748	387749	387750	387751	387752
Chloromethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Chloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Bromomethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Vinyl Chloride	µg/l	1	NONE	-	< 1.0	-	< 1.0	-
Trichlorofluoromethane	µg/l	1	NONE	-	< 1.0	-	< 1.0	-
1,1-Dichloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Cis-1,2-dichloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,1-Dichloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
2,2-Dichloropropane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Trichloromethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,1,1-Trichloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2-Dichloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,1-Dichloropropene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Trans-1,2-dichloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Benzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Tetrachloromethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2-Dichloropropane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Trichloroethene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Dibromomethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Bromodichloromethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Toluene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,1,2-Trichloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,3-Dichloropropane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Dibromochloromethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Tetrachloroethene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2-Dibromoethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Chlorobenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Ethylbenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
p & m-Xylene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Styrene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Tribromomethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
o-Xylene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Isopropylbenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Bromobenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
n-Propylbenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
2-Chlorotoluene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
4-Chlorotoluene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
tert-Butylbenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
sec-Butylbenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,3-Dichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
p-Isopropyltoluene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2-Dichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,4-Dichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Butylbenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
Hexachlorobutadiene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	-	< 1.0	-

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



Analytical Report Number: 14-62379  
Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387753	387754	387755	387756	387757
Sample Reference	BH111	BH101	BH102	BH9	BH103
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	2.66	2.89	2.62	2.82	0.68
Date Sampled	29/10/2014	29/10/2014	29/10/2014	29/10/2014	29/10/2014
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

#### General Inorganics

	pH Units	N/A	ISO 17025	8.0	7.4	7.7	7.3	11.6
Sulphate as SO <sub>4</sub>	µg/l	45	ISO 17025	64200	28300	154000	45600	987000
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	2.68	3.82	7.02	6.32	39.4

#### Speciated PAHs

	µg/l	0.01	ISO 17025	0.10	< 0.01	< 0.01	< 0.01	< 0.01
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	0.28	0.07	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	0.21	0.06	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	0.19	0.05	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

#### Total PAH

Total EPA-16 PAHs	µg/l	0.2	ISO 17025	0.78	< 0.20	< 0.20	< 0.20	< 0.20

#### Heavy Metals / Metalloids

	µg/l	0.15	ISO 17025	0.87	0.42	0.73	2.84	36.7
Arsenic (dissolved)	µg/l	10	ISO 17025	95	110	220	270	35
Boron (dissolved)	µg/l	0.02	ISO 17025	< 0.02	0.13	0.07	0.15	0.08
Cadmium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	0.5	< 0.2	120
Chromium (dissolved)	µg/l	0.5	ISO 17025	5.7	7.3	6.8	6.4	140
Copper (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	0.3	< 0.2	0.4
Lead (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	0.20
Mercury (dissolved)	µg/l	0.5	ISO 17025	4.7	9.6	8.4	5.5	63
Nickel (dissolved)	µg/l	0.6	ISO 17025	2.8	2.0	0.8	4.1	75
Selenium (dissolved)	µg/l	0.5	ISO 17025	< 0.5	5.6	2.3	1.1	< 0.5
Zinc (dissolved)								



Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387753	387754	387755	387756	387757			
Sample Reference	BH111	BH101	BH102	BH9	BH103			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	2.66	2.89	2.62	2.82	0.68			
Date Sampled	29/10/2014	29/10/2014	29/10/2014	29/10/2014	29/10/2014			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

**Monoaromatics**

Parameter	Units	Limit of detection	Accreditation Status	387753	387754	387755	387756	387757
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	13.5
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

**Petroleum Hydrocarbons**

Parameter	Units	Limit of detection	Accreditation Status	387753	387754	387755	387756	387757
TPH-CWG - Aliphatic >C5 - C6	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C6 - C8	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C8 - C10	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	130
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	700
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	810
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	460
<b>TPH-CWG - Aliphatic (C5 - C35)</b>	µg/l	10	NONE	< 10	< 10	< 10	< 10	2100

Parameter	Units	Limit of detection	Accreditation Status	387753	387754	387755	387756	387757
TPH-CWG - Aromatic >C5 - C7	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C7 - C8	µg/l	10	NONE	< 10	< 10	< 10	< 10	14
TPH-CWG - Aromatic >C8 - C10	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
<b>TPH-CWG - Aromatic (C5 - C35)</b>	µg/l	10	NONE	< 10	< 10	< 10	< 10	14





Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387753	387754	387755	387756	387757
Sample Reference	BH111	BH101	BH102	BH9	BH103
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	2.66	2.89	2.62	2.82	0.68
Date Sampled	29/10/2014	29/10/2014	29/10/2014	29/10/2014	29/10/2014
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

**VOCs**

Analytical Parameter	Units	Limit of detection	Accreditation Status	387753	387754	387755	387756	387757
Chloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,2-dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	13.5
1,1,2-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
n-Propylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
tert-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	2.6
sec-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

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



Analytical Report Number: 14-62379  
Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387758		387759		387760		387761		387762	
Sample Reference	BH8		BH104		BH1		BH2		BH3	
Sample Number	None Supplied		None Supplied		None Supplied		None Supplied		None Supplied	
Depth (m)	1.04		0.73		0.71		0.83		0.84	
Date Sampled	29/10/2014		30/10/2014		30/10/2014		30/10/2014		30/10/2014	
Time Taken	None Supplied		None Supplied		None Supplied		None Supplied		None Supplied	
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status							

**General Inorganics**

Parameter	Units	Limit of detection	ISO 17025	8.6	9.4	8.2	8.9	7.1
pH	pH Units	N/A	ISO 17025	8.6	9.4	8.2	8.9	7.1
Sulphate as SO <sub>4</sub>	µg/l	45	ISO 17025	146000	211000	46700	70300	129000
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	10.7	7.21	51.4	6.96	10.8

**Speciated PAHs**

Parameter	Units	Limit of detection	ISO 17025	0.20	0.16	2.4	< 0.01	< 0.01
Naphthalene	µg/l	0.01	ISO 17025	0.20	0.16	2.4	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	0.18	0.24	2.1	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	0.08	1.6	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	0.07	0.34	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.27	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.17	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.10	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.12	< 0.01	< 0.01

**Total PAH**

Parameter	Units	Limit of detection	ISO 17025	0.38	0.55	6.62	0.44	< 0.20
Total EPA-16 PAHs	µg/l	0.2	ISO 17025	0.38	0.55	6.62	0.44	< 0.20

**Heavy Metals / Metalloids**

Parameter	Units	Limit of detection	ISO 17025	15.5	4.26	30.7	6.21	0.58
Arsenic (dissolved)	µg/l	0.15	ISO 17025	15.5	4.26	30.7	6.21	0.58
Boron (dissolved)	µg/l	10	ISO 17025	160	360	140	130	180
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.02	< 0.02	0.03	< 0.02	0.13
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.4	< 0.2	1.8	< 0.2	< 0.2
Copper (dissolved)	µg/l	0.5	ISO 17025	9.8	5.4	7.3	4.1	7.7
Lead (dissolved)	µg/l	0.2	ISO 17025	0.7	< 0.2	1.2	< 0.2	< 0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	0.18	4.85	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	3.9	7.3	5.6	1.7	18
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.7	1.3	1.2	5.4	9.5
Zinc (dissolved)	µg/l	0.5	ISO 17025	1.1	1.3	3.0	0.7	1.5



Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

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Lab Sample Number	387758	387759	387760	387761	387762			
Sample Reference	BH8	BH104	BH1	BH2	BH3			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	1.04	0.73	0.71	0.83	0.84			
Date Sampled	29/10/2014	30/10/2014	30/10/2014	30/10/2014	30/10/2014			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

**Monoaromatics**

Parameter	Units	Limit of detection	Accreditation Status	387758	387759	387760	387761	387762
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

**Petroleum Hydrocarbons**

Parameter	Units	Limit of detection	Accreditation Status	387758	387759	387760	387761	387762
TPH-CWG - Aliphatic >C5 - C6	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C6 - C8	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C8 - C10	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
<b>TPH-CWG - Aliphatic (C5 - C35)</b>	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

Parameter	Units	Limit of detection	Accreditation Status	387758	387759	387760	387761	387762
TPH-CWG - Aromatic >C5 - C7	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C7 - C8	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C8 - C10	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
<b>TPH-CWG - Aromatic (C5 - C35)</b>	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10



Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387758		387759		387760		387761		387762	
Sample Reference	BH8		BH104		BH1		BH2		BH3	
Sample Number	None Supplied		None Supplied		None Supplied		None Supplied		None Supplied	
Depth (m)	1.04		0.73		0.71		0.83		0.84	
Date Sampled	29/10/2014		30/10/2014		30/10/2014		30/10/2014		30/10/2014	
Time Taken	None Supplied		None Supplied		None Supplied		None Supplied		None Supplied	
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status							

**VOCs**

Analytical Parameter	Units	Limit of detection	Accreditation Status	387758	387759	387760	387761	387762
Chloromethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Chloroethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Bromomethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Vinyl Chloride	µg/l	1	NONE	-	< 1.0	< 1.0	-	-
Trichlorofluoromethane	µg/l	1	NONE	-	< 1.0	< 1.0	-	-
1,1-Dichloroethene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,1-Dichloroethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
2,2-Dichloropropane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Trichloromethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,1,1-Trichloroethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,2-Dichloroethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,1-Dichloropropene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Benzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Tetrachloromethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,2-Dichloropropane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Trichloroethene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Dibromomethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Bromodichloromethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Toluene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,1,2-Trichloroethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,3-Dichloropropane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Dibromochloromethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Tetrachloroethene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,2-Dibromoethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Chlorobenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Ethylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
p & m-Xylene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Styrene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Tribromomethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
o-Xylene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Isopropylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Bromobenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
n-Propylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
2-Chlorotoluene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
4-Chlorotoluene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
tert-Butylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
sec-Butylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,3-Dichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
p-Isopropyltoluene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,2-Dichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,4-Dichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Butylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
Hexachlorobutadiene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0	-	-

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



Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387763	387764					
Sample Reference	BH4	BH5					
Sample Number	None Supplied	None Supplied					
Depth (m)	1.15	1.27					
Date Sampled	30/10/2014	30/10/2014					
Time Taken	None Supplied	None Supplied					
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				

**General Inorganics**

pH	pH Units	N/A	ISO 17025	7.5	7.2		
Sulphate as SO <sub>4</sub>	µg/l	45	ISO 17025	522000	15500		
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	10.3	5.82		

**Speciated PAHs**

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01		

**Total PAH**

Total EPA-16 PAHs	µg/l	0.2	ISO 17025	< 0.20	< 0.20		
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**Heavy Metals / Metalloids**

Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.49	1.02		
Boron (dissolved)	µg/l	10	ISO 17025	390	160		
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02	0.02		
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2		
Copper (dissolved)	µg/l	0.5	ISO 17025	4.9	11		
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2		
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05		
Nickel (dissolved)	µg/l	0.5	ISO 17025	10	5.8		
Selenium (dissolved)	µg/l	0.6	ISO 17025	2.1	0.7		
Zinc (dissolved)	µg/l	0.5	ISO 17025	2.5	1.4		



Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387763	387764					
Sample Reference	BH4	BH5					
Sample Number	None Supplied	None Supplied					
Depth (m)	1.15	1.27					
Date Sampled	30/10/2014	30/10/2014					
Time Taken	None Supplied	None Supplied					
<b>Analytical Parameter (Water Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>				

**Monoaromatics**

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0		
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0		
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0		
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0		

**Petroleum Hydrocarbons**

TPH-CWG - Aliphatic >C5 - C6	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aliphatic >C6 - C8	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aliphatic >C8 - C10	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10		
<b>TPH-CWG - Aliphatic (C5 - C35)</b>	µg/l	10	NONE	< 10	< 10		

TPH-CWG - Aromatic >C5 - C7	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aromatic >C7 - C8	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aromatic >C8 - C10	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10		
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10		
<b>TPH-CWG - Aromatic (C5 - C35)</b>	µg/l	10	NONE	< 10	< 10		



Analytical Report Number: 14-62379  
 Project / Site name: Project Lightning

Your Order No: ZLON

Lab Sample Number	387763	387764				
Sample Reference	BH4	BH5				
Sample Number	None Supplied	None Supplied				
Depth (m)	1.15	1.27				
Date Sampled	30/10/2014	30/10/2014				
Time Taken	None Supplied	None Supplied				
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status			

VOCs

Compound	Units	Limit of detection	Accreditation Status	387763	387764		
Chloromethane	µg/l	1	ISO 17025	-	-		
Chloroethane	µg/l	1	ISO 17025	-	-		
Bromomethane	µg/l	1	ISO 17025	-	-		
Vinyl Chloride	µg/l	1	NONE	-	-		
Trichlorofluoromethane	µg/l	1	NONE	-	-		
1,1-Dichloroethene	µg/l	1	ISO 17025	-	-		
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	-	-		
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	-	-		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	-	-		
1,1-Dichloroethane	µg/l	1	ISO 17025	-	-		
2,2-Dichloropropane	µg/l	1	ISO 17025	-	-		
Trichloromethane	µg/l	1	ISO 17025	-	-		
1,1,1-Trichloroethane	µg/l	1	ISO 17025	-	-		
1,2-Dichloroethane	µg/l	1	ISO 17025	-	-		
1,1-Dichloropropene	µg/l	1	ISO 17025	-	-		
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	-	-		
Benzene	µg/l	1	ISO 17025	-	-		
Tetrachloromethane	µg/l	1	ISO 17025	-	-		
1,2-Dichloropropane	µg/l	1	ISO 17025	-	-		
Trichloroethene	µg/l	1	ISO 17025	-	-		
Dibromomethane	µg/l	1	ISO 17025	-	-		
Bromodichloromethane	µg/l	1	ISO 17025	-	-		
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	-	-		
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	-	-		
Toluene	µg/l	1	ISO 17025	-	-		
1,1,2-Trichloroethane	µg/l	1	ISO 17025	-	-		
1,3-Dichloropropane	µg/l	1	ISO 17025	-	-		
Dibromochloromethane	µg/l	1	ISO 17025	-	-		
Tetrachloroethene	µg/l	1	ISO 17025	-	-		
1,2-Dibromoethane	µg/l	1	ISO 17025	-	-		
Chlorobenzene	µg/l	1	ISO 17025	-	-		
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	-	-		
Ethylbenzene	µg/l	1	ISO 17025	-	-		
p & m-Xylene	µg/l	1	ISO 17025	-	-		
Styrene	µg/l	1	ISO 17025	-	-		
Tribromomethane	µg/l	1	ISO 17025	-	-		
o-Xylene	µg/l	1	ISO 17025	-	-		
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	-	-		
Isopropylbenzene	µg/l	1	ISO 17025	-	-		
Bromobenzene	µg/l	1	ISO 17025	-	-		
n-Propylbenzene	µg/l	1	ISO 17025	-	-		
2-Chlorotoluene	µg/l	1	ISO 17025	-	-		
4-Chlorotoluene	µg/l	1	ISO 17025	-	-		
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	-	-		
tert-Butylbenzene	µg/l	1	ISO 17025	-	-		
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	-	-		
sec-Butylbenzene	µg/l	1	ISO 17025	-	-		
1,3-Dichlorobenzene	µg/l	1	ISO 17025	-	-		
p-Isopropyltoluene	µg/l	1	ISO 17025	-	-		
1,2-Dichlorobenzene	µg/l	1	ISO 17025	-	-		
1,4-Dichlorobenzene	µg/l	1	ISO 17025	-	-		
Butylbenzene	µg/l	1	ISO 17025	-	-		
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	-	-		
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	-	-		
Hexachlorobutadiene	µg/l	1	ISO 17025	-	-		
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	-	-		

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



**Analytical Report Number : 14-62379**

**Project / Site name: Project Lightning**

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Boron in water	Determination of boron by acidification followed by ICP-MS. Accredited matrices: SW, GW.	In-house method based on MEWAM	L012-PL	W	ISO 17025
BTEX and MTBE in water	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073W-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil"	L012-PL	W	ISO 17025
pH in water	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L070-UK	W	ISO 17025
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total organic carbon in water	Determination of total organic carbon in water by the measurement on a non-dispersive infrared analyser of carbon dioxide released by acidification. Determination of nitrite in water by addition of sulphanilamide and NED followed by colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-UK	W	NONE
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073W-PL	W	ISO 17025

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**

**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**

**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**



## Appendix D - GQRA Spreadsheets

## Summary of Statistics

Geology: MG / BE / Gravel / Clay

Site End Use: Residential With Plant Uptake

Soil Type: Sand - 1% SOM

Project Number: CS075666

Client: SEGRO

Compound	GAC (mg/kg)	No. Samples	Range of values (mg/kg)	exceeding GAC	Normality	No. Outliers	Test	UCL <sub>95%</sub> (of the true population mean)	Test Result
<b>Metals</b>									
Arsenic SGV	32	18	7.1 - 32	0	Normal	3	t	16.7	PASS
Boron	94	18	0.2 - 2.3	0	Normal	None	t	1.4	PASS
Cadmium SGV	10	18	0.2 - 0.3	0	Not Normal	1	c	0.2	PASS
Chromium VI	34	18	12 - 42	3	Normal	None	t	28.7	PASS
Copper	630	18	7.3 - 150	0	Normal	1	t	53.2	PASS
Lead	180	18	4.1 - 540	4	Normal	4	t	171.1	PASS
Mercury SGV	170	18	0.3 - 44	0	Not Normal	7	c	19.6	PASS
Nickel SGV	130	18	13 - 41	0	Normal	None	t	29.5	PASS
Selenium SGV	350	18	1 - 1	0					
Vanadium	200	18	17 - 73	0	Normal	None	t	47.2	PASS
Zinc	2200	18	20 - 450	0	Normal	3	t	137.3	PASS
<b>Non-Metals</b>									
Inorganic Cyanide	780	0							
<b>TPH</b>									
Aliphatic C5-6	17	18	0.1 - 0.1	0					
Aliphatic C6-8	33	18	0.1 - 0.1	0					
Aliphatic C8-10	7.8	18	0.1 - 0.1	0					
Aliphatic C10-12	44	18	1 - 1	0					
Aliphatic C12-16	210	18	2 - 6.6	0	Not Normal	2	c	3.8	PASS
Aliphatic C16-21	N/A	18	8 - 33	N/A	Not Normal	2	N/A	16.0	N/A
Aliphatic C21-35	N/A	18	8 - 140	N/A	Not Normal	3	N/A	50.4	N/A
Aliphatic C16-35	17000	18	10 - 180	0	Not Normal	2	c	65.5	PASS
Aromatic C8-10	11	18	0.1 - 0.1	0					
Aromatic C10-12	35	18	1 - 1	0					
Aromatic C12-16	91	18	2 - 6.1	0	Not Normal	1	c	3.2	PASS
Aromatic C16-21	200	18	10 - 40	0	Not Normal	2	c	19.0	PASS
Aromatic C21-35	790	18	10 - 140	0	Not Normal	4	c	56.9	PASS
<b>VOCs</b>									
Benzene SGV	0.054	18	0.001 - 0.001	0					
Chloroethene	0.00024	0							
1,2-Dichloroethane	0.0022	0							
Ethylbenzene SGV	42	18	0.001 - 0.001	0					
Naphthalene	5.5	0							
Tetrachloroethanes	0.41	0							
Tetrachloroethene	0.53	0							
Tetrachloromethane	0.0077	0							
Toluene SGV	92	18	0.001 - 0.001	0					
1,1,1-Trichloroethane	2.6	0							
Trichloroethene	0.045	0							
Xylenes SGV	20	18	0.001 - 0.001	0					
<b>SVOCs</b>									
Benz[a]anthracene	7.1	18	0.1 - 3.3	0	Not Normal	6	c	1.3	PASS
<b>Benzo[a]pyrene</b>	<b>1</b>	<b>18</b>	<b>0.1 - 2.5</b>	<b>3</b>	<b>Not Normal</b>	<b>6</b>	<b>c</b>	<b>1.1</b>	<b>FAIL</b>
Benzo[b]fluoranthene	8.2	18	0.1 - 3.1	0	Not Normal	6	c	1.2	PASS
Benzo[ghi]perylene	9.8	18	0.05 - 1.6	0	Not Normal	4	c	0.6	PASS
Benzo[k]fluoranthene	8.8	18	0.1 - 1.6	0	Not Normal	6	c	0.7	PASS
Chrysene	66	18	0.05 - 3.5	0	Not Normal	6	c	1.3	PASS
Dibenz[ah]anthracene	1	18	0.1 - 0.43	0	Not Normal	2	c	0.2	PASS
Fluoranthene	620	18	0.1 - 9.1	0	Not Normal	6	c	3.2	PASS
Indeno[123-cd]pyrene	7.8	18	0.1 - 1.2	0	Not Normal	4	c	0.5	PASS
Naphthalene	5.5	18	0.05 - 0.31	0	Not Normal	2	c	0.1	PASS
Phenol SGV	180	0							
Pyrene	770	18	0.1 - 6.9	0	Not Normal	3	c	2.5	PASS

## Summary of Statistics

Controlled Water: **Principal Aquifer &/or SPZ**Description: **Description of Controlled Water**

Project Number: CS075666

Client: SEGRO



Compound	GAC (µg/l)	No. Samples	Range of values (µg/l)	exceeding GAC	Normality	No. Outliers	Test	UCL <sub>95%</sub> (of the true population mean)	Test Result
<b>Metals</b>									
<b>Arsenic</b>	<b>10</b>	<b>17</b>	<b>0.24 - 36.7</b>	<b>3</b>	<b>Normal</b>	<b>3</b>	<b>t</b>	<b>11.2</b>	<b>FAIL</b>
Boron	1000	17	35 - 390	0	Normal	None	t	239.1	PASS
Cadmium	3	17	0.02 - 0.15	0	Not Normal	None	c	0.1	PASS
Chromium VI	50	17	0.2 - 120	<b>1</b>	Not Normal	<b>6</b>	c	38.3	PASS
Copper	2000	17	4.1 - 140	0	Not Normal	<b>4</b>	c	49.7	PASS
Lead	10	17	0.2 - 1.2	0	Not Normal	<b>5</b>	c	0.6	PASS
<b>Mercury</b>	<b>1</b>	<b>17</b>	<b>0.05 - 4.85</b>	<b>1</b>	<b>Not Normal</b>	<b>3</b>	<b>c</b>	<b>1.6</b>	<b>FAIL</b>
Nickel	20	17	1.7 - 63	<b>1</b>	Normal	<b>2</b>	t	15.8	PASS
<b>Selenium</b>	<b>10</b>	<b>17</b>	<b>0.6 - 75</b>	<b>1</b>	<b>Normal</b>	<b>4</b>	<b>t</b>	<b>14.7</b>	<b>FAIL</b>
Zinc	5000	17	0.5 - 5.6	0	Normal	<b>1</b>	t	2.5	PASS
<b>Non-Metals</b>									
Inorganic Cyanide	50	0							
<b>TPH</b>									
Aliphatic C5-6	N/A	17	10 - 10	0					
Aliphatic C6-8		17	10 - 10	0					
Aliphatic C8-10		17	10 - 10	0					
Aliphatic C10-12		17	10 - 130	0	Not Normal	<b>1</b>	c	47.8	
Aliphatic C12-16		17	10 - 700	0	Not Normal	<b>1</b>	c	227.6	
Aliphatic C16-21		17	10 - 810	0	Not Normal	<b>1</b>	c	262.2	
Aliphatic C21-35		0							
Aliphatic C16-35		0							
Aromatic C8-10		17	10 - 10	0					
Aromatic C10-12		17	10 - 10	0					
Aromatic C12-16		17	10 - 10	0					
Aromatic C16-21		17	10 - 10	0					
Aromatic C21-35		17	10 - 10	0					
<b>Total TPH</b>		<b>10</b>	<b>17</b>	<b>10 - 2114</b>	<b>1</b>	<b>Not Normal</b>	<b>1</b>	<b>c</b>	<b>673.4</b>
<b>VOCs</b>									
MTBE	5	17	1 - 1	0					
Benzene	1	17	1 - 1	0					
Chloroethene	0.5	9	1 - 1	<b>9</b>					
1,2-Dichloroethane	3	9	1 - 1	0					
Ethylbenzene	2	17	1 - 1	0					
Naphthalene	10	17	0.01 - 2.4	0	Not Normal	<b>4</b>	c	0.8	PASS
Tetrachloroethanes	0.05	9	1 - 1	<b>9</b>					
Tetrachloroethene	10	9	1 - 1	0					
Tetrachloromethane	2	0							
Toluene	24	17	1 - 13.5	0	Not Normal	<b>1</b>	c	4.9	PASS
1,1,1-Trichloroethane	100	9	1 - 1	0					
Trichloroethene	10	9	1 - 1	0					
Xylenes	20	17	1 - 1	0					
<b>SVOCs</b>									
Benzo[b]fluoranthene	0.1	17	0.01 - 0.01	0					
Benzo[k]fluoranthene	0.1	17	0.01 - 0.01	0					
Benzo[ghi]perylene	0.1	17	0.01 - 0.12	<b>1</b>	Not Normal	<b>1</b>	c	0.0	PASS
Benzo[a]pyrene	0.01	17	0.01 - 0.01	0					
Indeno[123-cd]pyrene	0.1	17	0.01 - 0.1	0	Not Normal	<b>1</b>	c	0.0	PASS
Naphthalene	10	17	0.01 - 2.4	0	Not Normal	<b>4</b>	c	0.8	PASS
Phenol	0.5	0							

# Appendix E – Laboratory Geotechnical Testing Results

## SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 • m (%)	Bulk Mg/m³	Dry Mg/m³	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 (g/L)	W/S Mg (mg/L)	
101		0.50-1.00	D	Mottled orange, red and brown sandy gravelly silty CLAY. Gravel is flint.	25	27	20	7.0	79									
101		2.50-3.00	D	Yellow brown very sandy GRAVEL														Particle Size Distribution
102		0.30-0.50	D	Brown clayey sandy gravelly SILT. Gravel is flint with rare fine brick fragments	17	NP	NP	NP	57									
102		3.50-4.00	D	Yellow brown sandy GRAVEL														Particle Size Distribution
102		5.50-5.95	U	Stiff fissured brown silty CLAY	29					1.98	1.53	110	177	89				
104		1.00-1.50	D	Dark orange and grey-brown slightly sandy gravelly silty CLAY	21	30	19	11	77									
104		3.00-3.45	D	Yellow brown sandy GRAVEL														Particle Size Distribution
104		5.00-5.50	D	Grey-brown and orange sandy gravelly CLAY. Gravel is fine to medium flint.	32	68	32	36	87									
104		5.50-5.95	U	Stiff fissured brown silty CLAY	28					2.01	1.57	110	139	70				
104		6.00	D	Dark grey-brown silty CLAY	29	70	26	44	100									
107		1.00-1.40	D	Mottled brown and orange sandy gravelly silty CLAY. Gravel is fine to medium and includes fine brick fragments.	26	31	19	12	82									
107		2.00-2.50	D	Yellow brown very sandy GRAVEL														Particle Size Distribution


Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by  Senior Technician 17/11/2014	Project Number:  <b style="text-align: center;">GEO / 21922</b>  Project Name:  <b style="text-align: center;">PROJECT LIGHTNING CSO756566</b>	
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## SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 • m (%)	Bulk Mg/m³	Dry Mg/m³	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 (g/L)	W/S Mg (mg/L)	
107		5.40-5.85	U	Stiff fissured brown silty CLAY	29					2.00	1.55	110	137	69				
108		0.00-0.50	B	Greyish brown very sandy very gravelly silty CLAY														Particle Size Distribution
109		0.50-1.00	D	Brown clayey sandy GRAVEL which includes brick, concrete and flint	8.4	32	24	8.0	14									
109		3.00-3.45	B	Yellow brown slightly silty sandy GRAVEL														Particle Size Distribution
109		3.50-4.00	B	Orange-brown sandy gravelly silty CLAY. Gravel is fine to medium flint.	25	69	30	39	77									
111		1.10-1.60	B	Yellow brown silty very sandy GRAVEL														Particle Size Distribution
112		1.20-2.15	B	Yellow brown silty very sandy GRAVEL														Particle Size Distribution
113		5.20-5.65	U	Firm to stiff greyish brown silty CLAY	29					2.01	1.56	105	151	76				

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by  Senior Technician 17/11/2014	Project Number: <p style="text-align: center;"><b>GEO / 21922</b></p> Project Name: <p style="text-align: center;"><b>PROJECT LIGHTNING CSO756566</b></p>	
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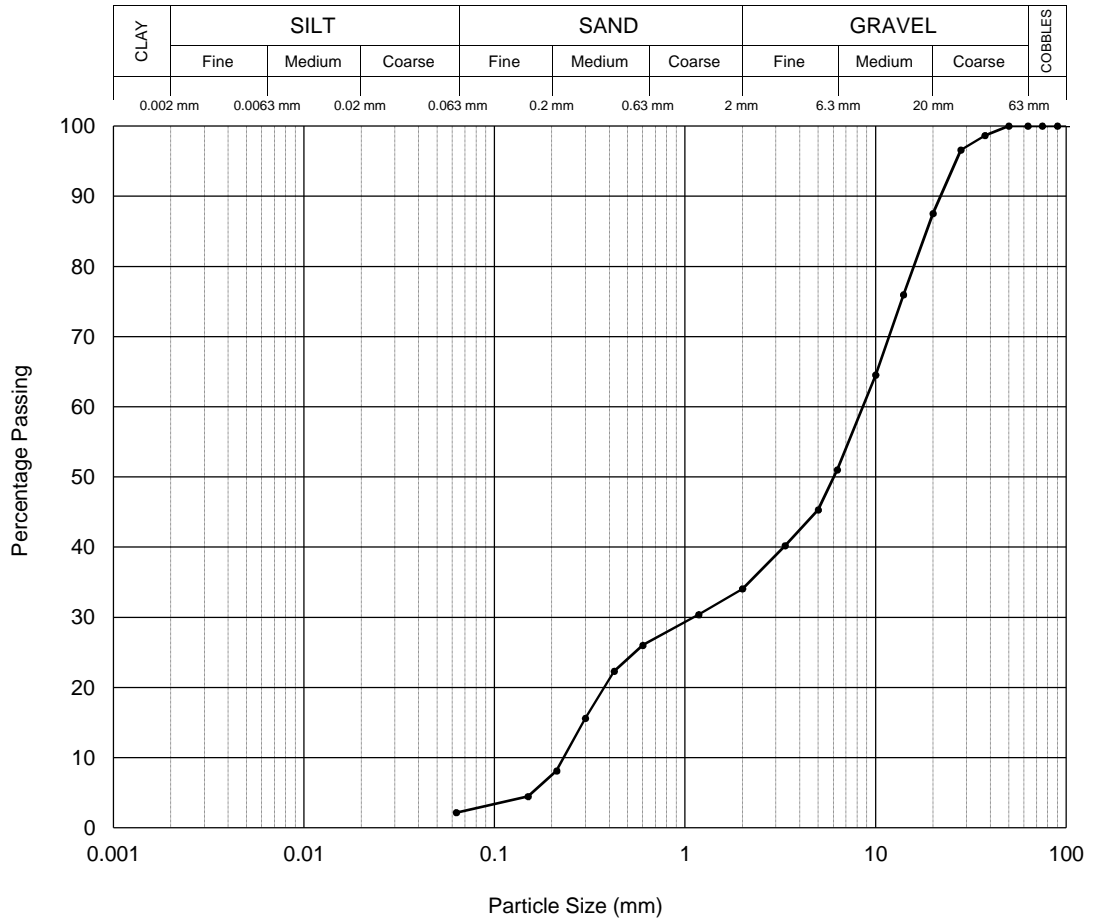
# PARTICLE SIZE DISTRIBUTION

BH/TP No: 101  
 Depth (m): 2.50-3.00  
 Sample Type: D

Description:  
 Yellow brown very sandy GRAVEL

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	99
28	97
20	88
14	76
10	65
6.3	51
5	45
3.35	40
2	34
1.18	30
0.6	26
0.425	22
0.3	16
0.212	8
0.15	4
0.063	2



Particle Proportions	
Cobbles	0.0 %
Gravel	65.9 %
Sand	31.9 %
Silt & Clay	2.2 %

Checked and Approved by

*S Burke*

Senior Technician  
 17/11/2014

Project Number:

**GEO / 21922**

Project Name:

**PROJECT LIGHTNING  
 CSO756566**

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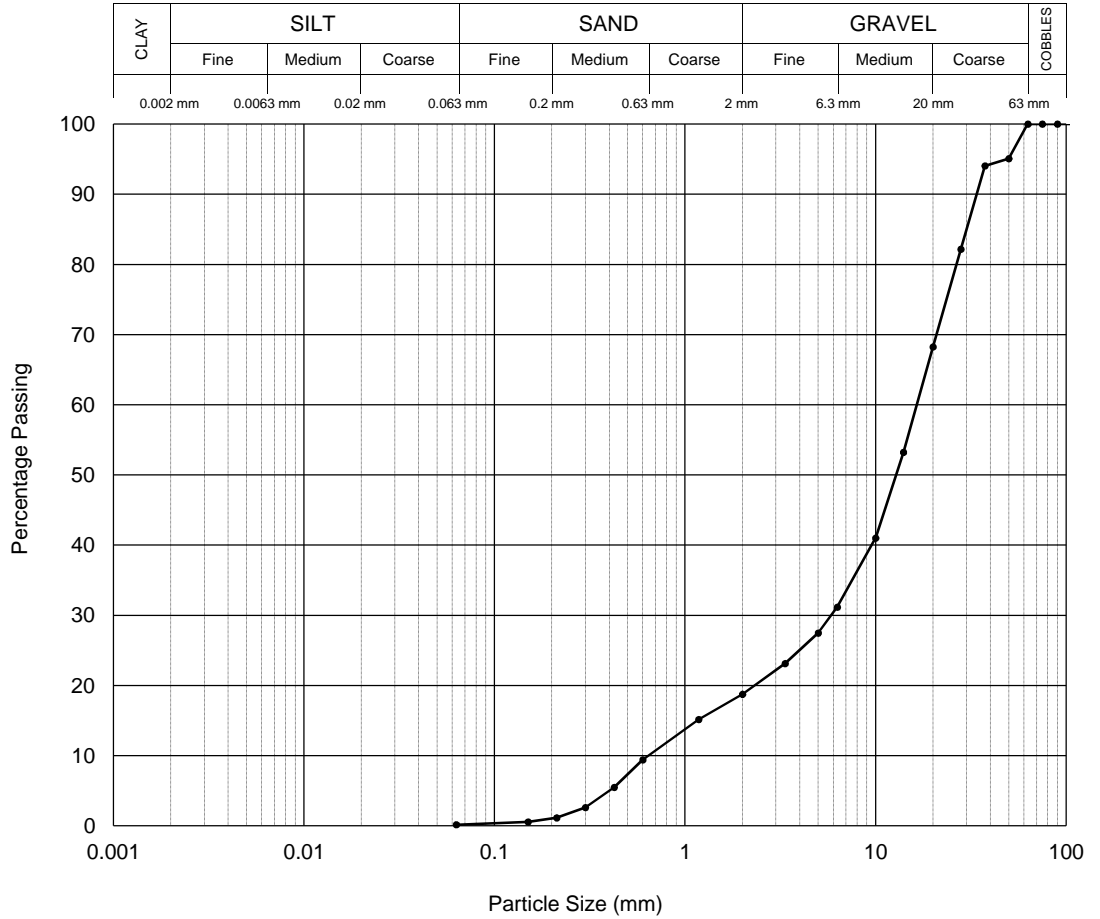
# PARTICLE SIZE DISTRIBUTION

BH/TP No: 102  
 Depth (m): 3.50-4.00  
 Sample Type: D

Description:  
 Yellow brown sandy GRAVEL

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	95
37.5	94
28	82
20	68
14	53
10	41
6.3	31
5	27
3.35	23
2	19
1.18	15
0.6	9
0.425	5
0.3	3
0.212	1
0.15	1
0.063	0



Particle Proportions	
Cobbles	0.0 %
Gravel	81.3 %
Sand	18.6 %
Silt & Clay	0.2 %

Checked and Approved by

*S Burke*

Senior Technician  
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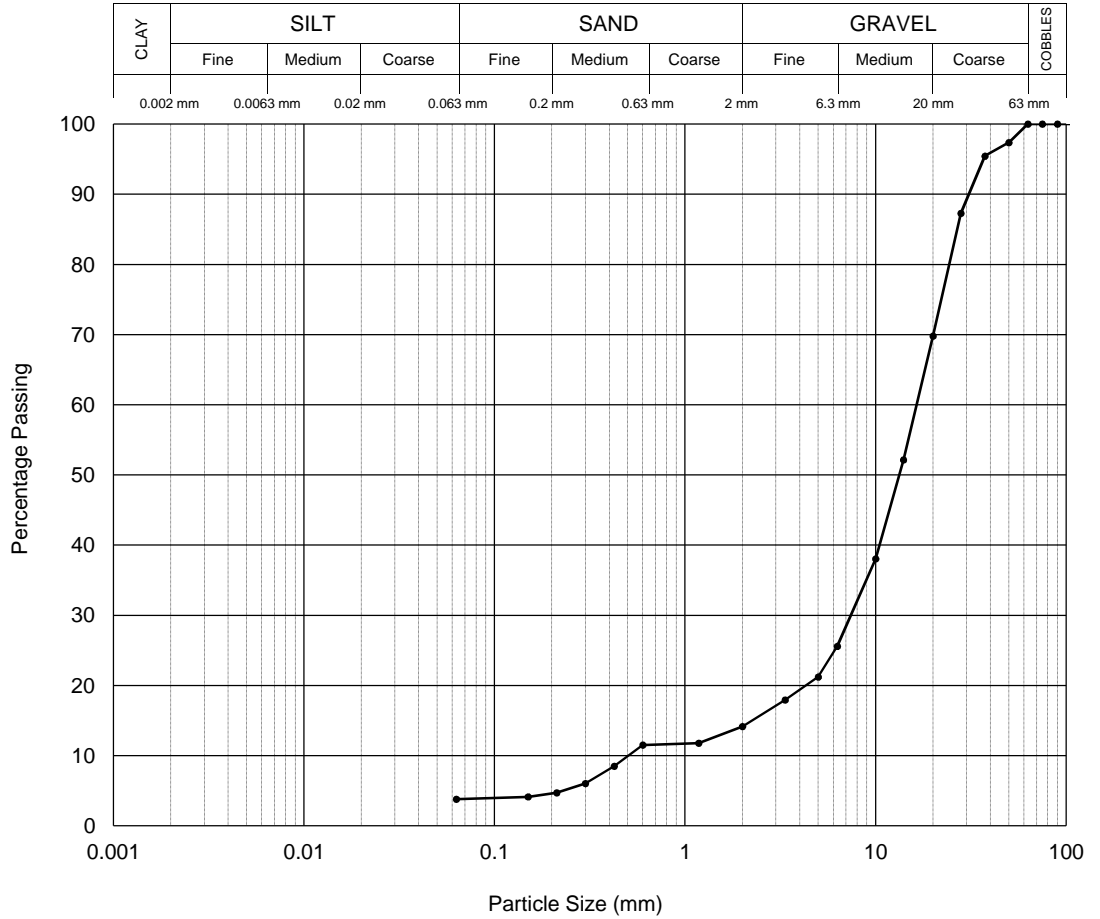
# PARTICLE SIZE DISTRIBUTION

BH/TP No: 104  
 Depth (m): 3.00-3.45  
 Sample Type: D

Description:  
 Yellow brown sandy GRAVEL

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	97
37.5	95
28	87
20	70
14	52
10	38
6.3	26
5	21
3.35	18
2	14
1.18	12
0.6	12
0.425	9
0.3	6
0.212	5
0.15	4
0.063	4



Particle Proportions	
Cobbles	0.0 %
Gravel	85.8 %
Sand	10.4 %
Silt & Clay	3.8 %

Checked and Approved by

*S Burke*

Senior Technician  
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Project Number:

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Project Name:

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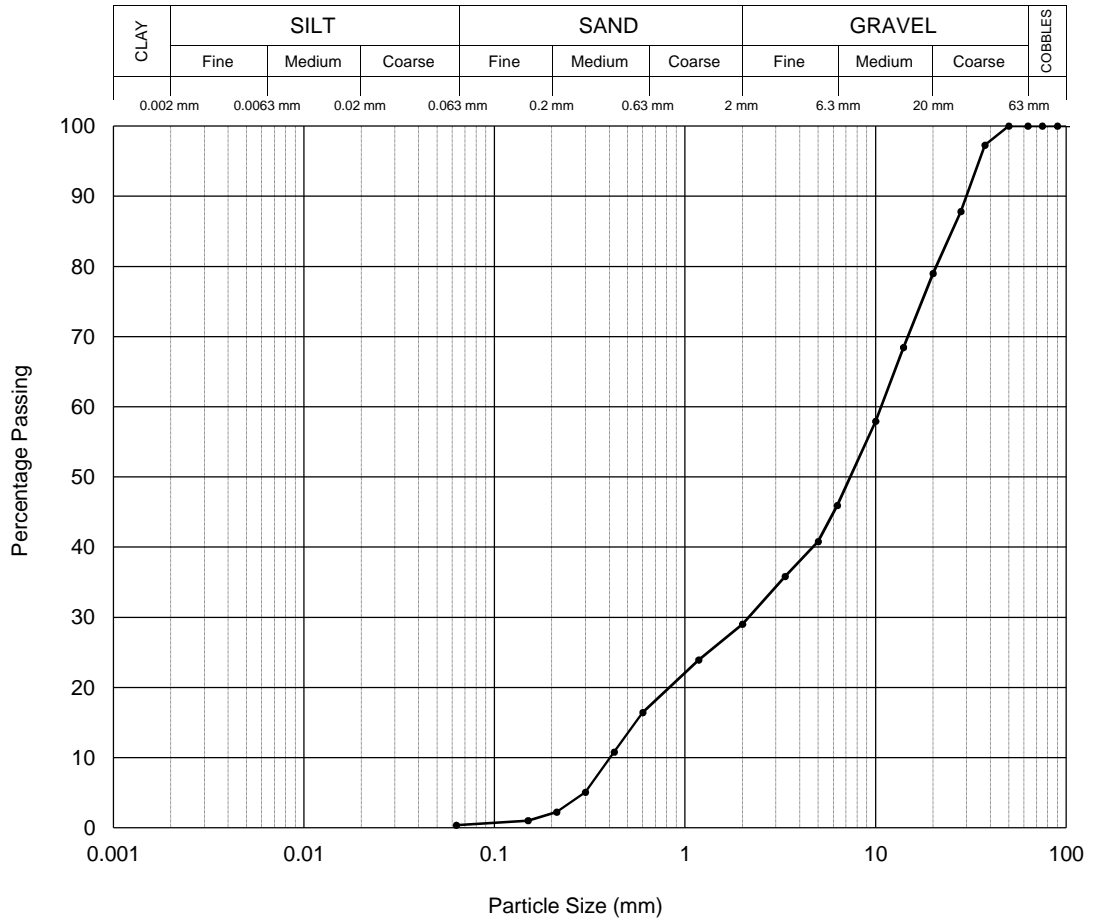
# PARTICLE SIZE DISTRIBUTION

BH/TP No: 107  
 Depth (m): 2.00-2.50  
 Sample Type: D

Description:  
 Yellow brown very sandy GRAVEL

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	97
28	88
20	79
14	68
10	58
6.3	46
5	41
3.35	36
2	29
1.18	24
0.6	16
0.425	11
0.3	5
0.212	2
0.15	1
0.063	0



Particle Proportions	
Cobbles	0.0 %
Gravel	71.0 %
Sand	28.6 %
Silt & Clay	0.4 %

Checked and Approved by

*S Burke*

Senior Technician  
 17/11/2014

Project Number:

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Project Name:

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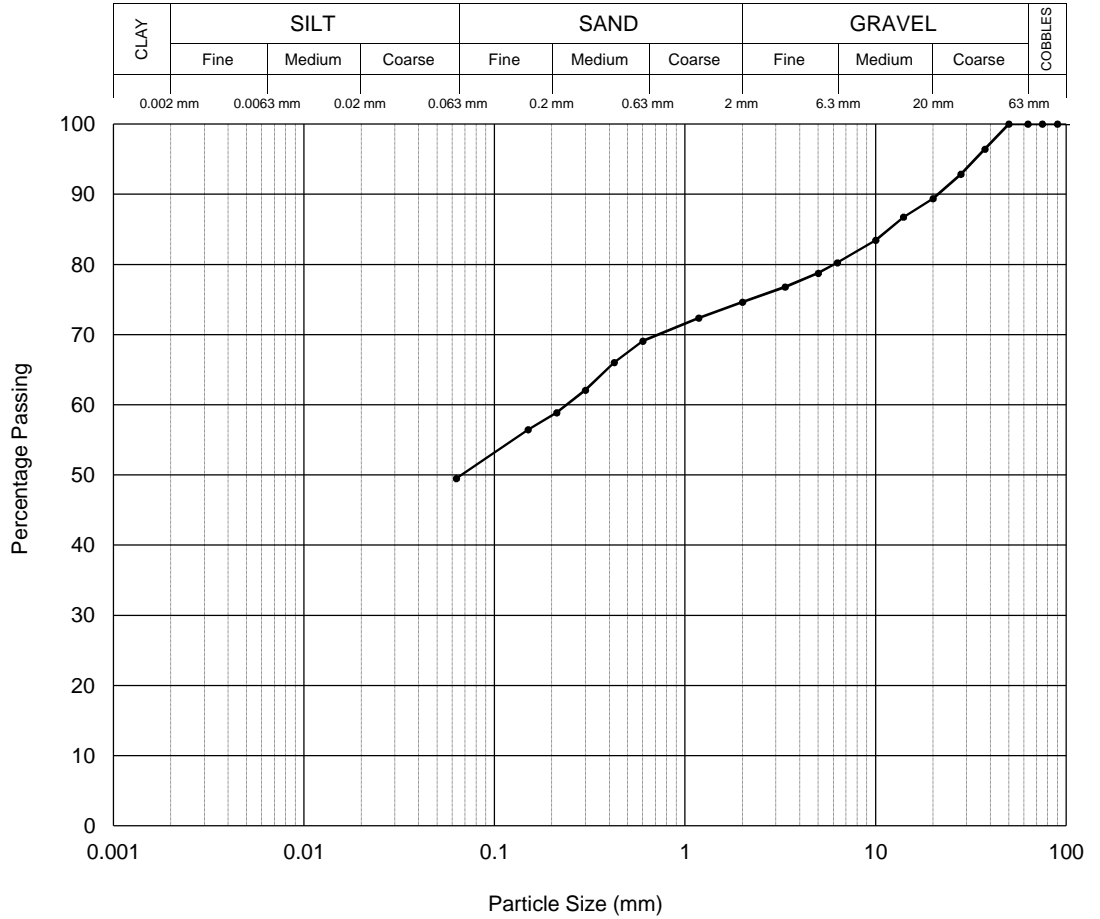
# PARTICLE SIZE DISTRIBUTION

BH/TP No: 108  
 Depth (m): 0.00-0.50  
 Sample Type: B

Description:  
 Greyish brown very sandy very gravelly silty CLAY

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	96
28	93
20	89
14	87
10	83
6.3	80
5	79
3.35	77
2	75
1.18	72
0.6	69
0.425	66
0.3	62
0.212	59
0.15	56
0.063	49



Particle Proportions	
Cobbles	0.0 %
Gravel	25.4 %
Sand	25.1 %
Silt & Clay	49.5 %

Checked and Approved by

*S Burke*

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Project Number:

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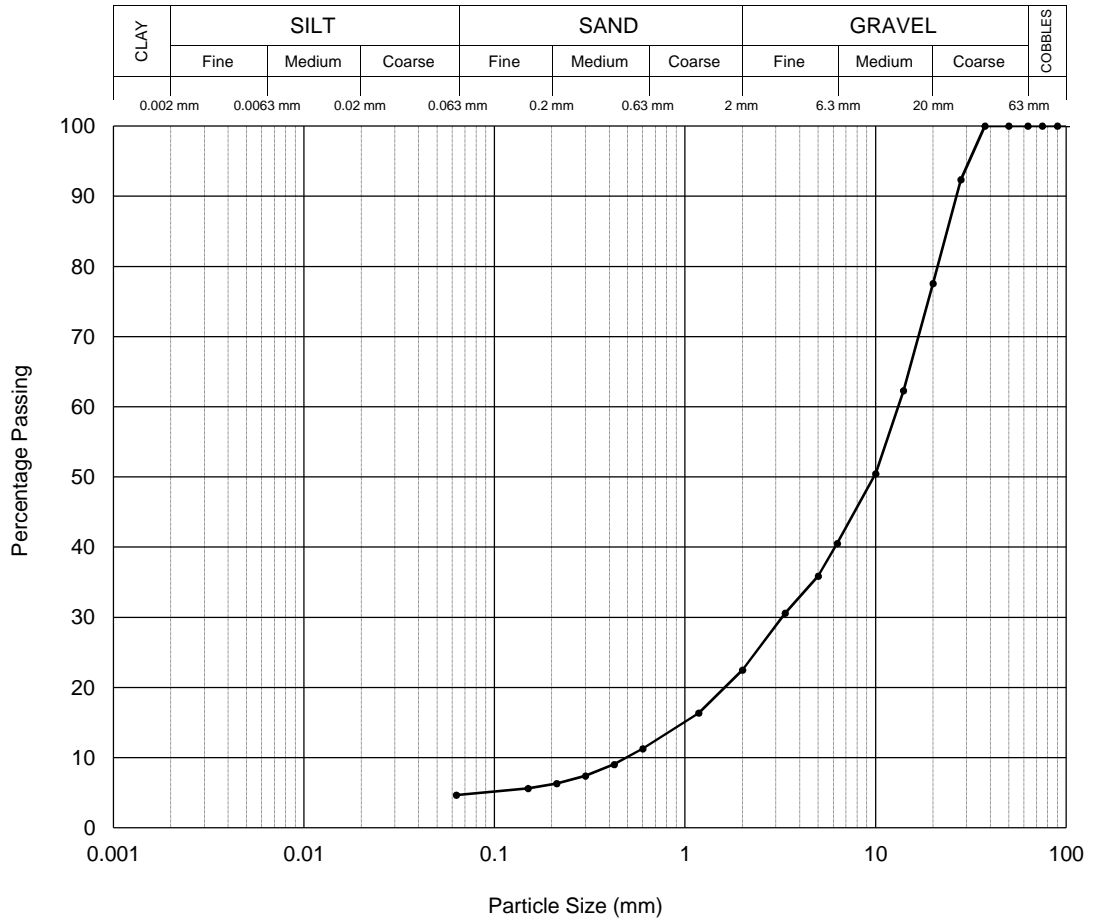
# PARTICLE SIZE DISTRIBUTION

BH/TP No: 109  
 Depth (m): 3.00-3.45  
 Sample Type: B

Description:  
 Yellow brown slightly silty sandy GRAVEL

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	92
20	78
14	62
10	50
6.3	41
5	36
3.35	31
2	22
1.18	16
0.6	11
0.425	9
0.3	7
0.212	6
0.15	6
0.063	5



Particle Proportions	
Cobbles	0.0 %
Gravel	77.5 %
Sand	17.8 %
Silt & Clay	4.7 %

Checked and Approved by

*S Burke*

Senior Technician  
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Project Number:

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Project Name:

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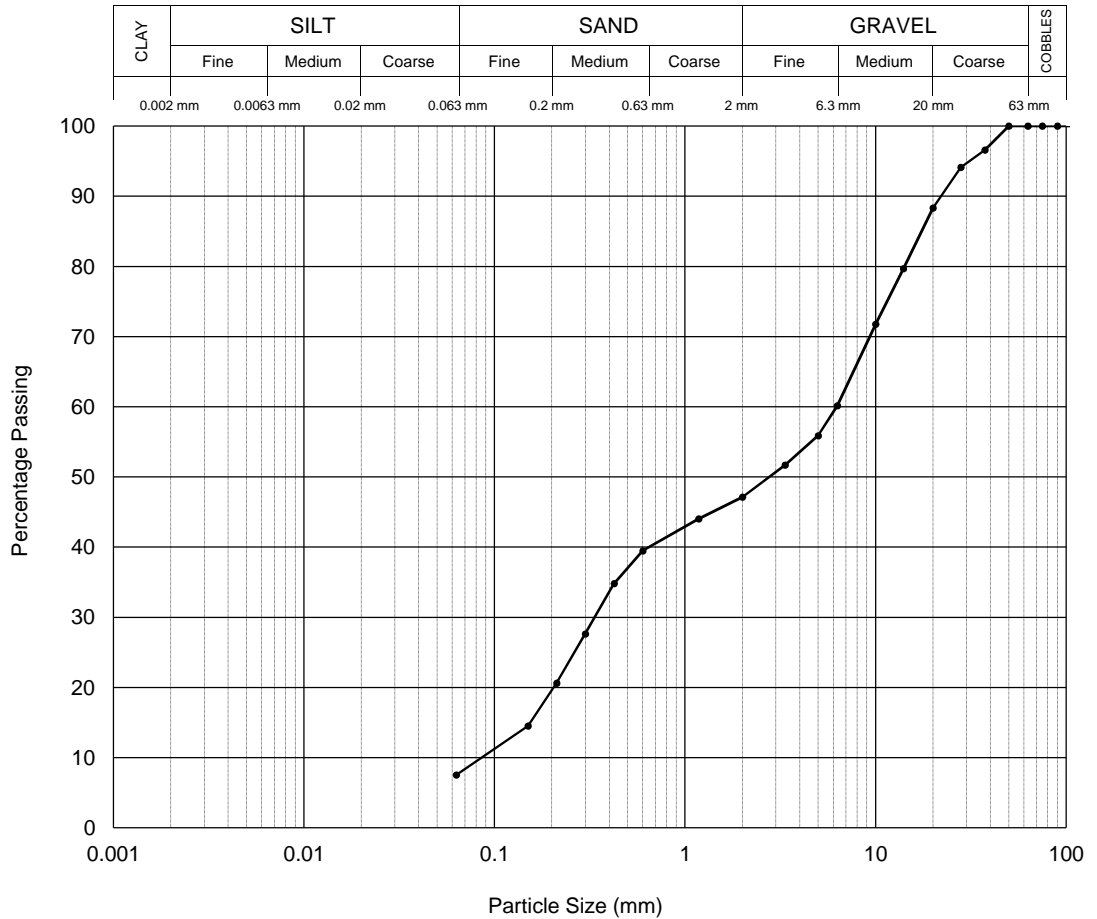
# PARTICLE SIZE DISTRIBUTION

BH/TP No: 111  
 Depth (m): 1.10-1.60  
 Sample Type: B

Description:  
 Yellow brown silty very sandy GRAVEL

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	97
28	94
20	88
14	80
10	72
6.3	60
5	56
3.35	52
2	47
1.18	44
0.6	39
0.425	35
0.3	28
0.212	21
0.15	15
0.063	8



Particle Proportions	
Cobbles	0.0 %
Gravel	52.9 %
Sand	39.6 %
Silt & Clay	7.5 %

Checked and Approved by

*S Burke*

Senior Technician  
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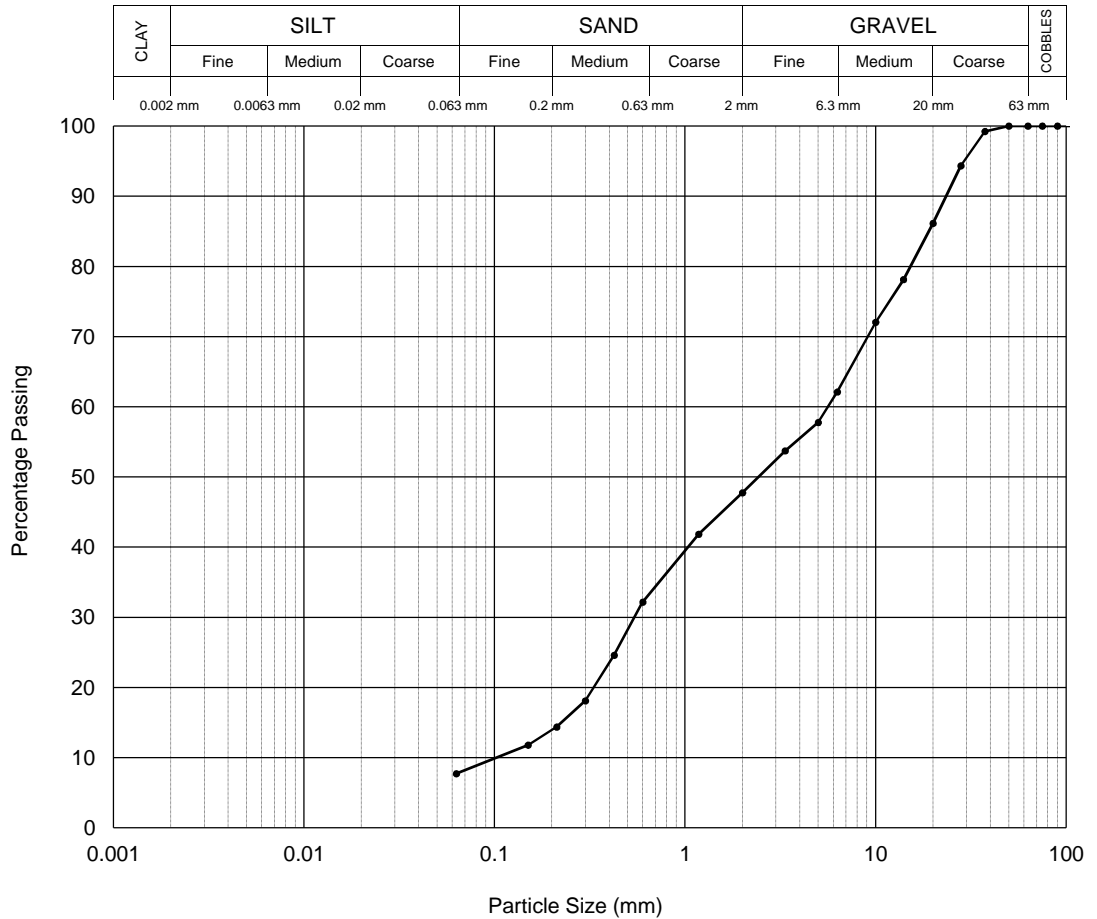
# PARTICLE SIZE DISTRIBUTION

BH/TP No: 112  
 Depth (m): 1.20-2.15  
 Sample Type: B

Description:  
 Yellow brown silty very sandy GRAVEL

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	99
28	94
20	86
14	78
10	72
6.3	62
5	58
3.35	54
2	48
1.18	42
0.6	32
0.425	25
0.3	18
0.212	14
0.15	12
0.063	8



Particle Proportions	
Cobbles	0.0 %
Gravel	52.2 %
Sand	40.0 %
Silt & Clay	7.7 %

Checked and Approved by

*S Burke*

Senior Technician  
 17/11/2014

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Project Name:

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## SUMMARY OF CHEMICAL TESTS ON SOIL

Borehole / Trial Pit	Depth m	Sample Ref	Sample Type	pH Value	Total Acid Soluble Sulphate as SO <sub>4</sub> %	Water Soluble Sulphate as SO <sub>4</sub> 2:1 Water:Soil Extract g/L	Total Sulphur %	Water Soluble Chloride mg/L	Water Soluble Nitrate mg/L	Magnesium mg/L	Organic Content %	Mass Loss on Ignition %	Carbonate Content %
102	5.00-5.50		D	8.2	0.05	0.46	0.18	63	<2.0				
104	0.50-1.00		D	8.3	0.12	0.13	0.08	79	<2.0				
107	0.50-1.00		D	8.4	0.06	0.25	0.03	49	<2.0				
107	3.50-4.00		D	8.2	0.02	0.41	0.02	67	<2.0				
107	5.10-5.40		D	8.1	0.07	0.61	0.35	65	<2.0				
109	0.00-0.50		D	7.5	0.11	0.59	0.15	170	<2.0				

Checked and Approved by:


Senior Technician  
17/11/2014

Project Number:

GEO / 21922

Project Name:

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CSO756566


1731 - UUTXL 102 05.50 U - 21922-103905.xls

# QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

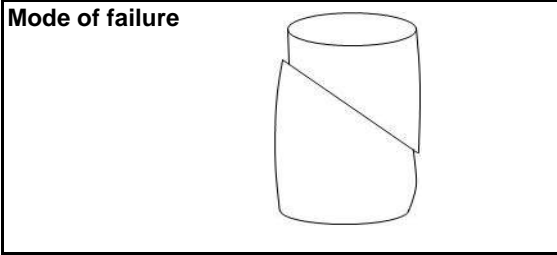
BH/TP No	102
Depth (m)	5.50-5.95
Sample Type	U

Description:  
Stiff fissured brown silty CLAY

### Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.1
Diameter	(mm)	102.4
Moisture Content	(%)	29
Bulk Density	(Mg/m <sup>3</sup> )	1.98
Dry Density	(Mg/m <sup>3</sup> )	1.53
Test Details		
Latex membrane thickness	(mm)	0.30
Membrane correction	(kPa)	0.53
Axial displacement rate	(%/min)	1.99
Cell pressure	(kPa)	110
Strain at failure	(%)	7.5
Maximum Deviator Stress	(kPa)	177
Shear Stress Cu	(kPa)	89

### Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	80

GL:Version 036 - 12/11/2014

Checked and Approved by:  
*S Burke*  
Senior Technician  
17/11/2014

Project Number: **GEO / 21922**  
Project Name: **PROJECT LIGHTNING**  
**CSO756566**





# QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

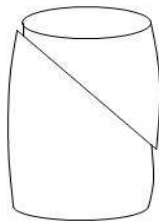
BH/TP No	104
Depth (m)	5.50-5.95
Sample Type	U

Description:  
Stiff fissured brown silty CLAY

### Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.1
Diameter	(mm)	102.4
Moisture Content	(%)	28
Bulk Density	(Mg/m <sup>3</sup> )	2.01
Dry Density	(Mg/m <sup>3</sup> )	1.56
Test Details		
Latex membrane thickness	(mm)	0.30
Membrane correction	(kPa)	0.47
Axial displacement rate	(%/min)	1.99
Cell pressure	(kPa)	110
Strain at failure	(%)	6.5
Maximum Deviator Stress	(kPa)	139
Shear Stress Cu	(kPa)	70

### Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	80

Checked and Approved by:  
*S Burke*  
Senior Technician  
17/11/2014

Project Number: **GEO / 21922**  
Project Name: **PROJECT LIGHTNING**  
**CSO756566**



1731 - UUTXL 107.05.40 U - 21922-103904.xls

# QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

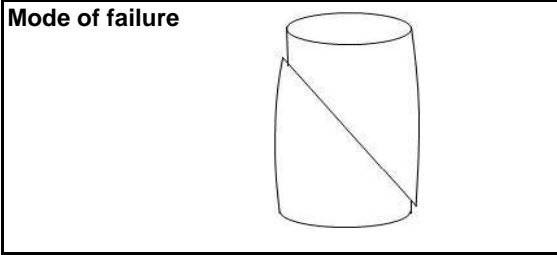
BH/TP No	107
Depth (m)	5.40-5.85
Sample Type	U

Description:  
Stiff fissured brown silty CLAY

### Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.2
Diameter	(mm)	102.1
Moisture Content	(%)	29
Bulk Density	(Mg/m <sup>3</sup> )	2.00
Dry Density	(Mg/m <sup>3</sup> )	1.55
Test Details		
Latex membrane thickness	(mm)	0.30
Membrane correction	(kPa)	0.44
Axial displacement rate	(%/min)	1.99
Cell pressure	(kPa)	110
Strain at failure	(%)	6.0
Maximum Deviator Stress	(kPa)	137
Shear Stress Cu	(kPa)	69

### Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	210

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Checked and Approved by:  
*S Burke*  
Senior Technician  
17/11/2014

Project Number: **GEO / 21922**  
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**CSO756566**



# QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

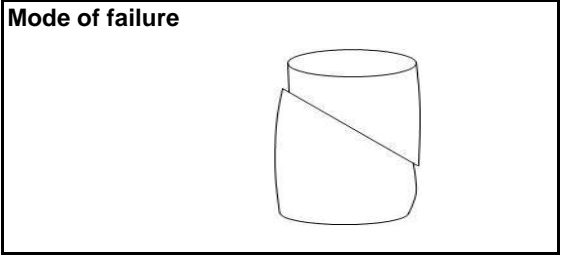
BH/TP No	113
Depth (m)	5.20-5.65
Sample Type	U

Description:  
Firm to stiff greyish brown silty CLAY

### Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	200.7
Diameter	(mm)	104.3
Moisture Content	(%)	29
Bulk Density	(Mg/m <sup>3</sup> )	2.01
Dry Density	(Mg/m <sup>3</sup> )	1.56
Test Details		
Latex membrane thickness	(mm)	0.30
Membrane correction	(kPa)	1.09
Axial displacement rate	(%/min)	1.99
Cell pressure	(kPa)	105
Strain at failure	(%)	19.9
Maximum Deviator Stress	(kPa)	151
Shear Stress Cu	(kPa)	76

### Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	40

Checked and Approved by:  
*S Burke*  
Senior Technician  
17/11/2014

Project Number: **GEO / 21922**  
Project Name: **PROJECT LIGHTNING**  
**CS0756566**



# Appendix F - Groundwater and Ground Gas Monitoring Data

Ground Gas and Groundwater Monitoring Data Sheet

Project name: Project Lightning, Hayes

Project number: CS-075666

Date: 29/10/2014

Monitoring Location	Ground level (mAOD)	Methane (% by vol)	Carbon Dioxide (% by vol)	Oxygen (% by vol)	Flow (l/hr)	Atmospheric Pressure (mbar)	PID (ppm)	LNAPL (mbgl)	Water Level (mbgl)	Water Level (mAOD)	Standpipe Base Depth (mbgl)	Comments
BH101	31.27	0.0	0.3	20.5	0.1	1015	0.0	n/d	2.89	28.38	6.28	
BH102	31.01	0.0	0.1	18.7	0.1	1015	0.0	n/d	2.62	28.39	4.62	
BH103	31.20	0.0	0.0	18.7	0.2	1015	1.2	n/d	0.68	30.52	1.06	
BH104	31.00	0.3	1.1	15.3	7.7	1016	0.0	n/d	0.73	30.27	4.87	
BH107	31.29	0.1	0.5	20.3	0.0	1013	0.0	n/d	1.50	29.79	5.07	
BH108	30.90	0.0	2.1	18.4	0.0	1013	0.0	n/d	1.58	29.32	2.16	No water sample, not enough water
BH109	29.82	0.0	0.1	18.6	0.0	1012	1.4	n/d	1.56	28.26	3.54	
BH111	30.98	0.7	0.0	3.1	0.0	1013	220.0	n/d	2.66	28.32	4.44	
BH112	31.37	0.0	0.8	19.2	1.0	1012	0.0	n/d	Dry	Dry	2.17	No water sample, dry
BH113	31.08	0.1	2.8	9.9	0.1	1015	104.0	n/d	1.96	29.12	3.90	
BH1	30.51	-	-	-	-	-	0.0	n/d	0.71	29.80	3.99	No gas valve
BH2	30.44	-	-	-	-	-	0.0	n/d	0.83	29.61	3.96	No gas valve
BH3	30.19	-	-	-	-	-	0.0	n/d	0.84	29.35	3.49	No gas valve
BH4	29.53	-	-	-	-	-	0.0	n/d	1.15	28.38	3.12	No gas valve
BH5	29.27	-	-	-	-	-	0.0	n/d	1.27	28.00	4.19	No gas valve
BH6	30.15	-	-	-	-	-	0.0	n/d	1.59	28.56	4.06	No gas valve
BH7	31.17	-	-	-	-	-	0.0	n/d	1.49	29.68	5.04	No gas valve
BH8	31.14	-	-	-	-	-	0.0	n/d	1.04	30.10	3.36	No gas valve
BH9	31.20	-	-	-	-	-	1.8	n/d	2.82	28.38	5.19	No gas valve
WS13	31.21	0.0	0.3	20.0	0.0	1015	0.0	n/d	1.27	29.94	1.77	Gas valve too big
WS17	31.24	-	-	-	-	-	0.0	n/d	0.77	30.47	1.99	Gas valve too big
WS22	30.39	-	-	-	-	-	0.0	n/d	0.74	29.65	1.90	Gas valve too big

Equipment: GA 5000 Infra-red gas analyser  
MiniREA PID  
Dip meter

Logged by: GEA

Ground Gas and Groundwater Monitoring Data Sheet

Project name: Project Lightning, Hayes

Project number: CS-075666

Date: 05/11/2014

Monitoring Location	Ground level (mAOD)	Methane (% by vol)	Carbon Dioxide (% by vol)	Oxygen (% by vol)	Flow (l/hr)	Atmospheric Pressure (mbar)	PID (ppm)	LNAPL (mbgl)	Water Level (mbgl)	Water Level (mAOD)	Standpipe Base Depth (mbgl)
BH101	31.27	0.0	0.4	20.7	1.1	1002	0		2.79	28.48	6.28
BH102	31.01	0.1	1.1	11.9	0.0	1002	0		2.51	28.50	4.62
BH103	31.20	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading
BH104	31.00	0.0	0.5	20.3	6.9	1002	0.9		0.79	30.21	4.61
BH107	31.29	0.2	1.0	19.6	0.0	1001	0		1.39	29.90	5.06
BH108	30.90	0.0	2.4	17.2	0.0	999	0		1.41	29.49	2.15
BH109	29.82	0.0	0.1	20.4	0.0	1003	0.7		1.70	28.12	3.54
BH111	30.98	0.3	0.0	7.5	0.0	1002	144		2.56	28.42	4.44
BH112	31.37	0.0	0.9	19.1	1.0	1002	0		Dry	Dry	2.17
BH113	31.08	0.0	1.7	10.2	1.8	1001	59		1.42	29.66	3.78

Equipment: GA 5000 Infra-red gas analyser  
Dip meter  
MiniREA PID

Logged by: GEA

Ground Gas and Groundwater Monitoring Data Sheet

Project name: Project Lightning, Hayes

Project number: CS-075666

Date: 18/11/2014

Monitoring Location	Ground level (mAOD)	Methane (% by vol)	Carbon Dioxide (% by vol)	Oxygen (% by vol)	Flow (l/hr)	Atmospheric Pressure (mbar)	PID (ppm)	LNAPL (mbgl)	Water Level (mbgl)	Water Level (mAOD)	Standpipe Base Depth (mbgl)
BH101	31.27	0.0	0.8	20.0	0.7	1008	0.0		2.70	28.57	6.31
BH102	31.01	0.5	1.1	6.1	0.0	1008	0.0		2.41	28.60	4.62
BH103	31.20	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading	No Reading
BH104	31.00	0.1	0.6	19.2	2.4	1008	1.4		0.77	30.23	4.63
BH107	31.29	0.2	1.0	18.1	0.0	1007	0.0		1.44	29.85	5.06
BH108	30.90	0.0	3.0	14.4	0.0	1006	0.0		1.44	29.46	2.15
BH109	29.82	0.0	0.1	17.8	0.0	1005	0.5		1.15	28.67	3.54
BH111	30.98	0.2	0.0	7.4	0.0	1008	127.0		2.46	28.52	4.44
BH112	31.37	0.0	1.3	18.6	0.0	1008	0.0		Dry	Dry	2.17
BH113	31.08	0.0	0.0	12.8	0.2	1006	51.0		1.50	29.58	3.75

Equipment: GA 5000 Infra-red gas analyser  
Dip meter  
MiniREA PID

Logged by: GEA

## Appendix G – Envirocheck Extracts



# Geology 1:50,000 Maps Legends

## Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	WGR	Worked Ground (Undivided)	Void	Holocene - Holocene
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	WMGR	Infilled Ground	Artificial Deposit	Present Day - Present Day

## Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Flandrian
	LASI	Langley Silt Member	Clay and Silt	Devensian - Devensian
	LHGR	Lynch Hill Gravel Member	Sand and Gravel	Wolstonian - Wolstonian
	TPGR	Taplow Gravel Formation	Sand and Gravel	Wolstonian - Wolstonian
	BHT	Boyn Hill Gravel Member	Sand and Gravel	Wolstonian - Hoxnian

## Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LC	London Clay Formation	Clay, Silt and Sand	Eocene - Eocene
	LC	London Clay Formation	Clay and Silt	Eocene - Eocene

## Geology 1:50,000 Maps

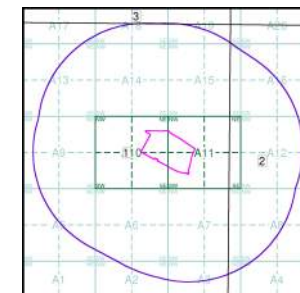
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

## Geology 1:50,000 Maps Coverage

Map ID:	3	Map ID:	1
Map Sheet No:	255	Map Sheet No:	269
Map Name:	Beaconsfield	Map Name:	Windsor
Map Date:	2005	Map Date:	1999
Bedrock Geology:	Available	Bedrock Geology:	Available
Superficial Geology:	Available	Superficial Geology:	Available
Artificial Geology:	Available	Artificial Geology:	Available
Faults:	Available	Faults:	Available
Landslip:	Available	Landslip:	Available
Rock Segments:	Not Available	Rock Segments:	Not Available
Map ID:	2		
Map Sheet No:	270		
Map Name:	South London		
Map Date:	1998		
Bedrock Geology:	Available		
Superficial Geology:	Available		
Artificial Geology:	Available		
Faults:	Available		
Landslip:	Available		
Rock Segments:	Not Available		

## Geology 1:50,000 Maps - Slice A

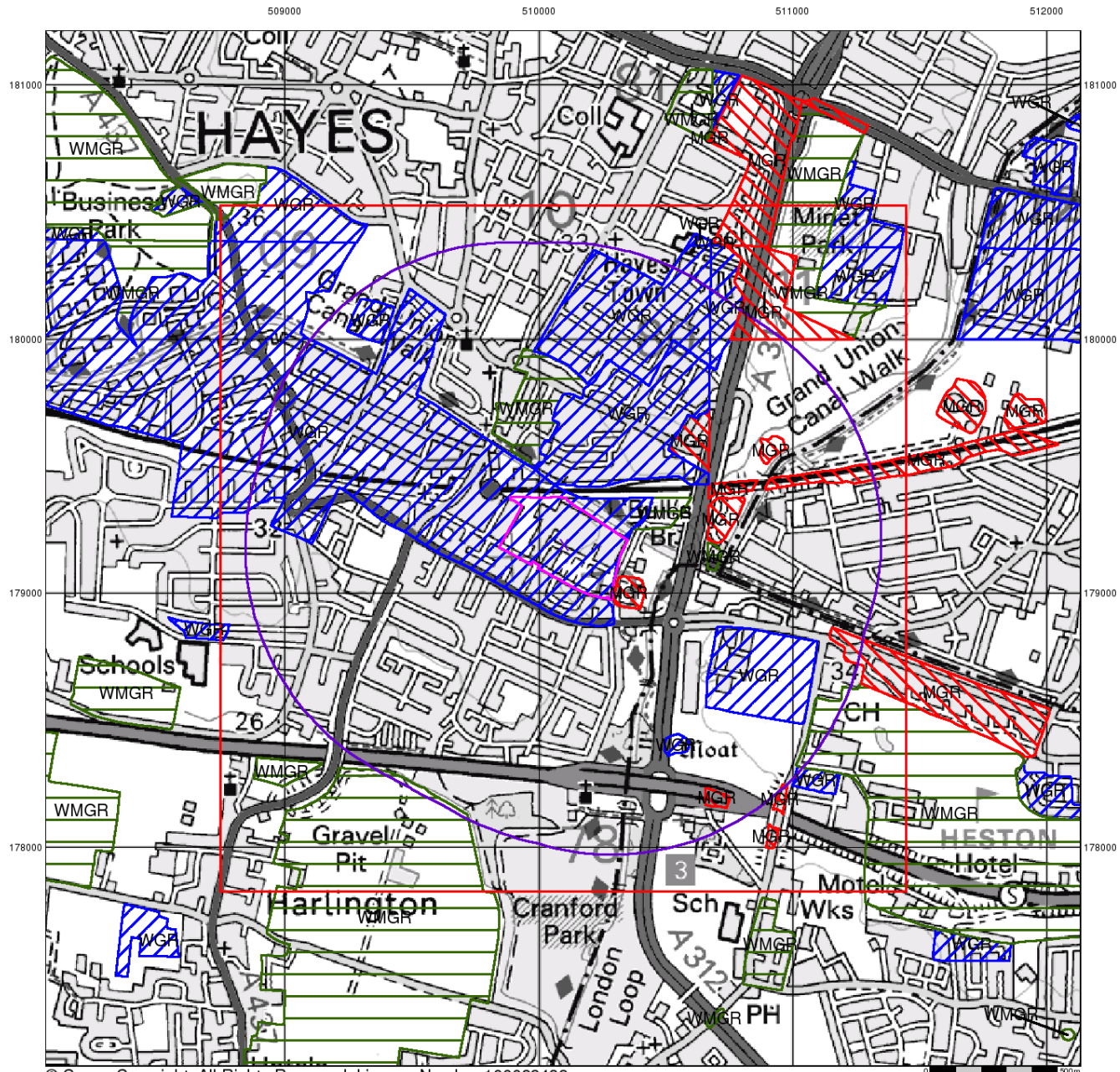


## Order Details:

Order Number: 48644303\_1\_1  
 Customer Reference: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

## Site Details:

Nestle UK Ltd, Beverage Division, North Hyde Gardens, HAYES, Middlesex, UB3 4RF



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### Artificial Ground and Landslip

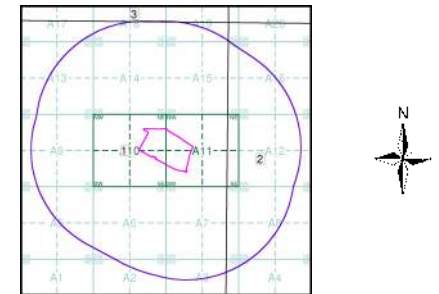
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

### Artificial Ground and Landslip Map - Slice A

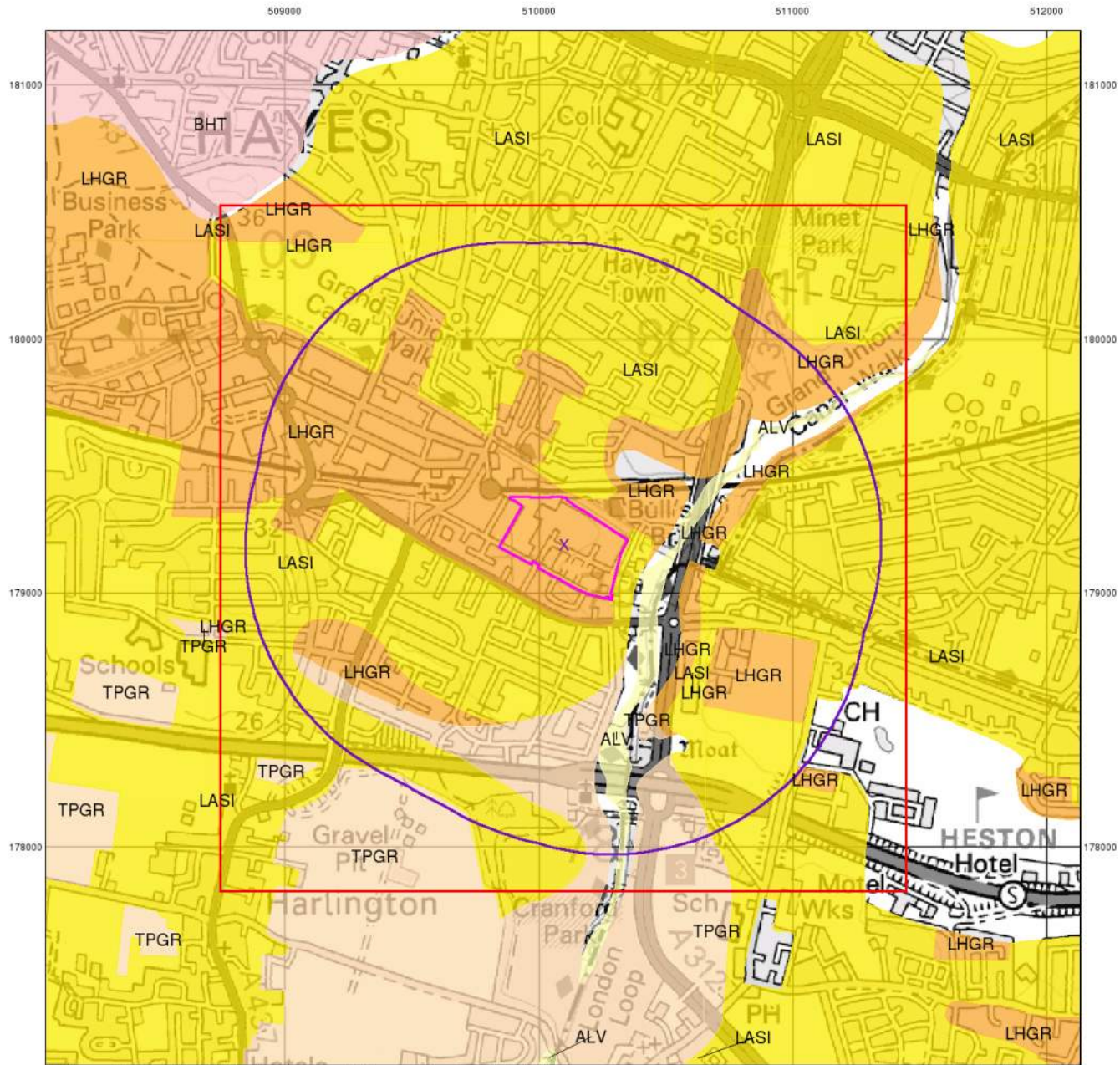


### Order Details:

Order Number: 48644303\_1\_1  
 Customer Reference: GCU0124020  
 National Grid Reference: 510100, 179190  
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 Site Area (Ha): 12.29  
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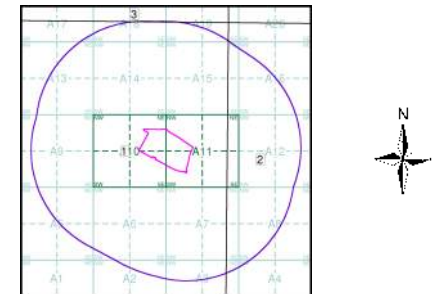
### Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

### Superficial Geology Map - Slice A



### Order Details:

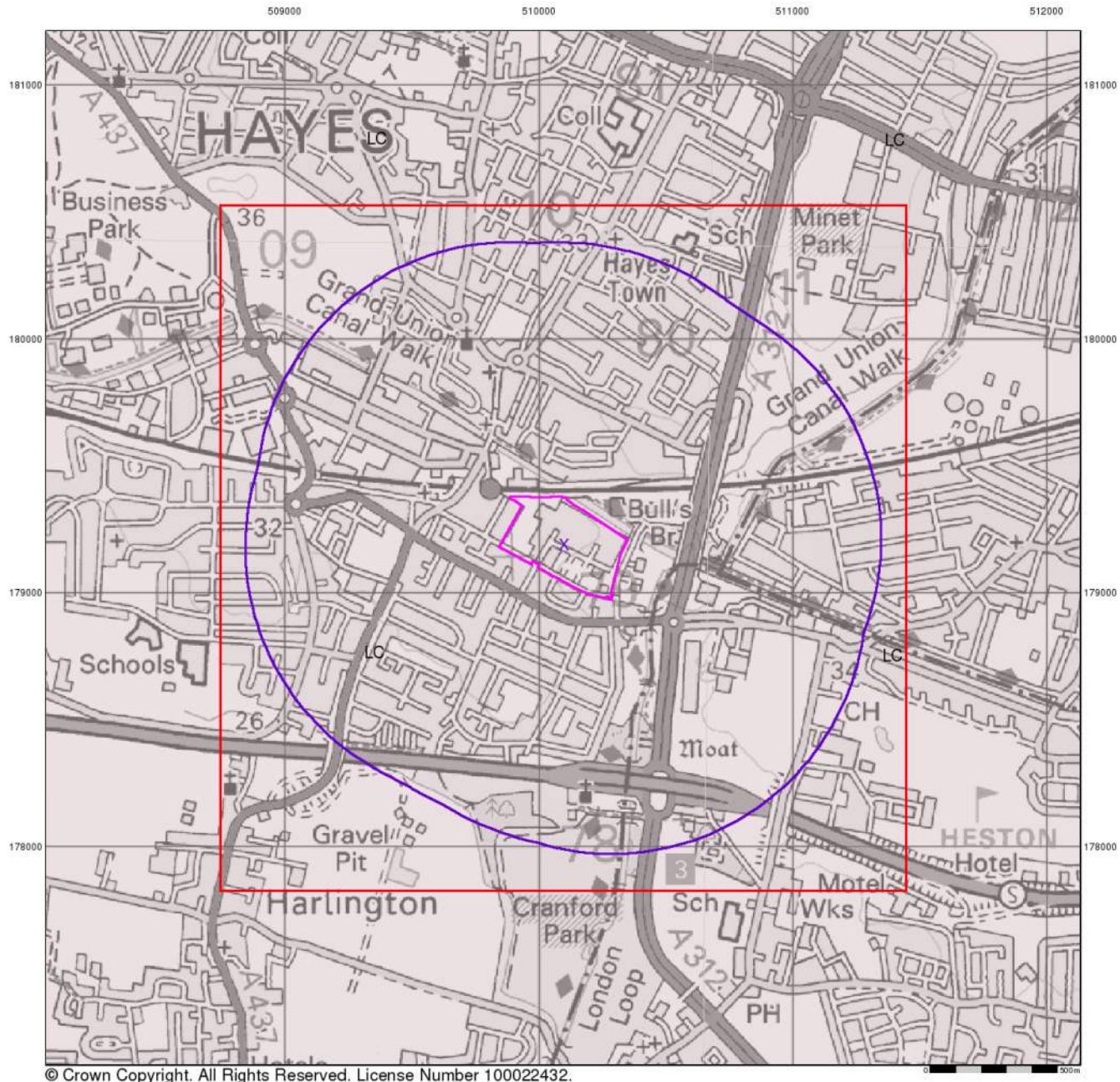
Order Number: 48644303\_1\_1  
 Customer Reference: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details:

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### Bedrock and Faults

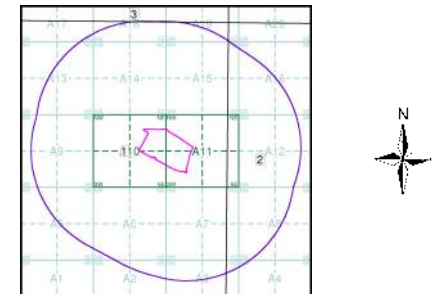
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

### Bedrock and Faults Map - Slice A

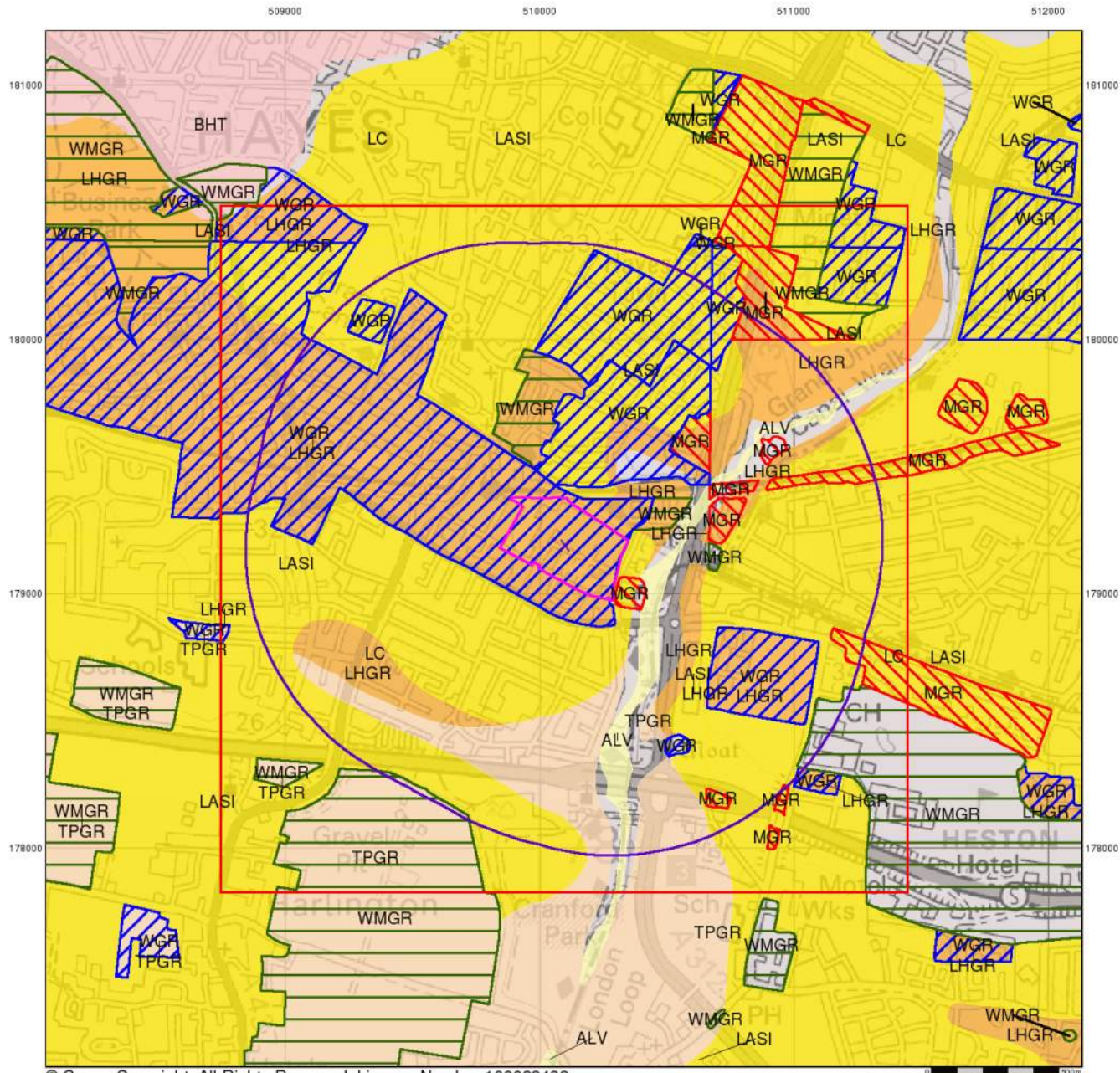


### Order Details:

Order Number: 48644303\_1\_1  
 Customer Reference: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
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### Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

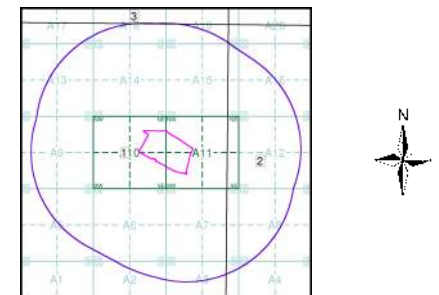
### Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

### Contact

British Geological Survey  
 Kingsley Dunham Centre  
 Keyworth  
 Nottingham  
 NG12 5GG  
 Telephone: 0115 936 3143  
 Fax: 0115 936 3276  
 email: enquiries@bgs.ac.uk  
 website: www.bgs.ac.uk

### Combined Geology Map - Slice A



### Order Details:

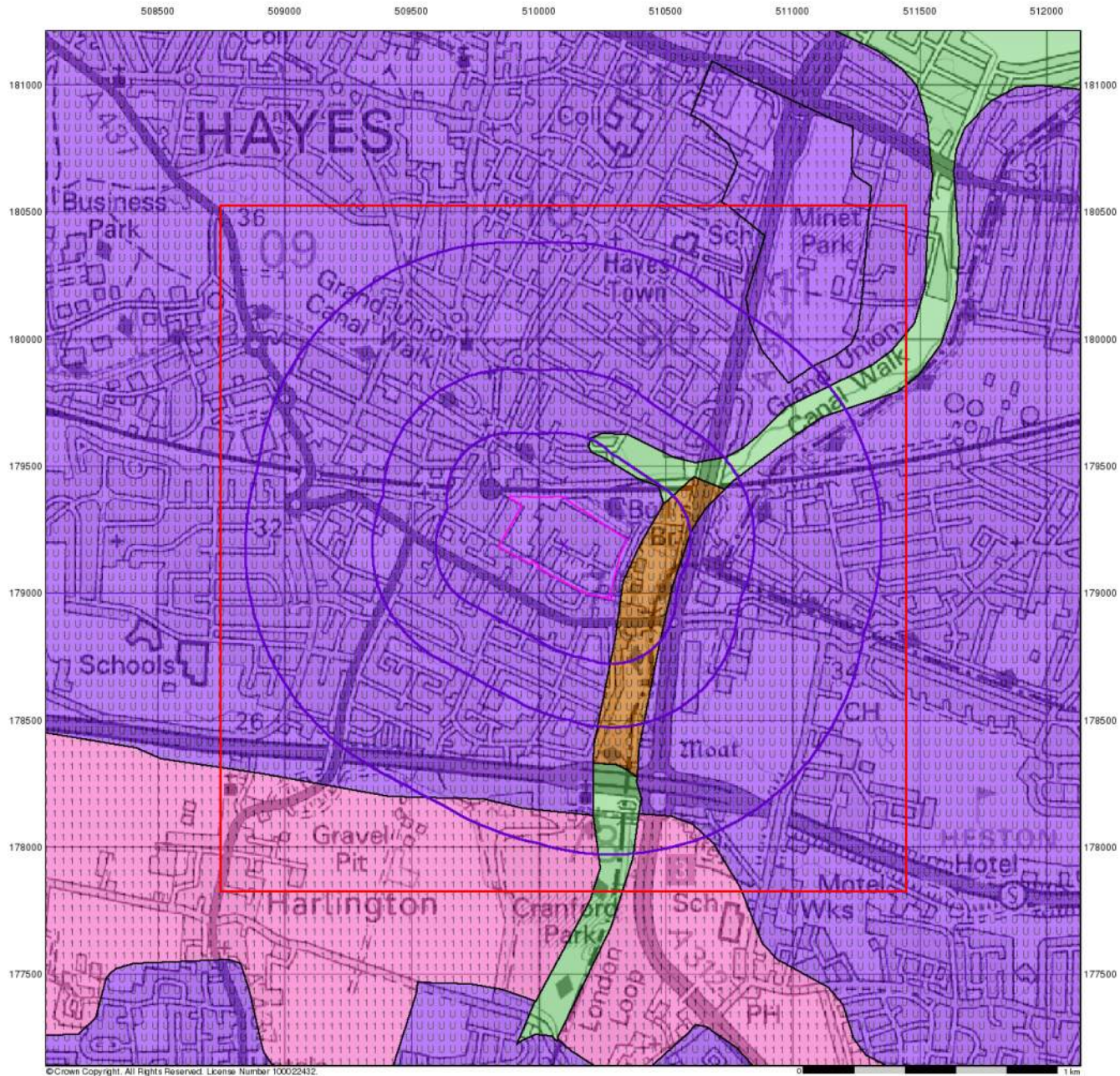
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 Customer Reference: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details:

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## Groundwater Vulnerability

### General

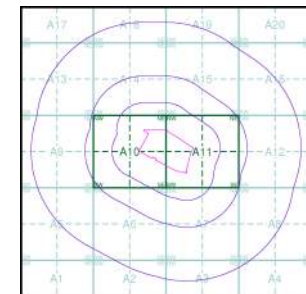
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

### Agency and Hydrological

#### Geological Classes

- |   |  |                       |
|---|--|-----------------------|
| <b>Major Aquifer (Highly Permeable)</b>   |  | High (H) 1, 2, 3, U   |
|   |  | Intermediate (I) 1, 2 |
|   |  | Low                   |
| <b>Minor Aquifer (Variably Permeable)</b> |  | High (H) 1, 2, 3, U   |
|   |  | Intermediate (I) 1, 2 |
|   |  | Low                   |
| <b>Non Aquifer (Negligibly Permeable)</b> |  |                       |
| <b>Water or Sea</b>                       |  |                       |
| <b>Drift Deposit</b>                      |  |                       |

### Site Sensitivity Context Map - Slice A



### Order Details

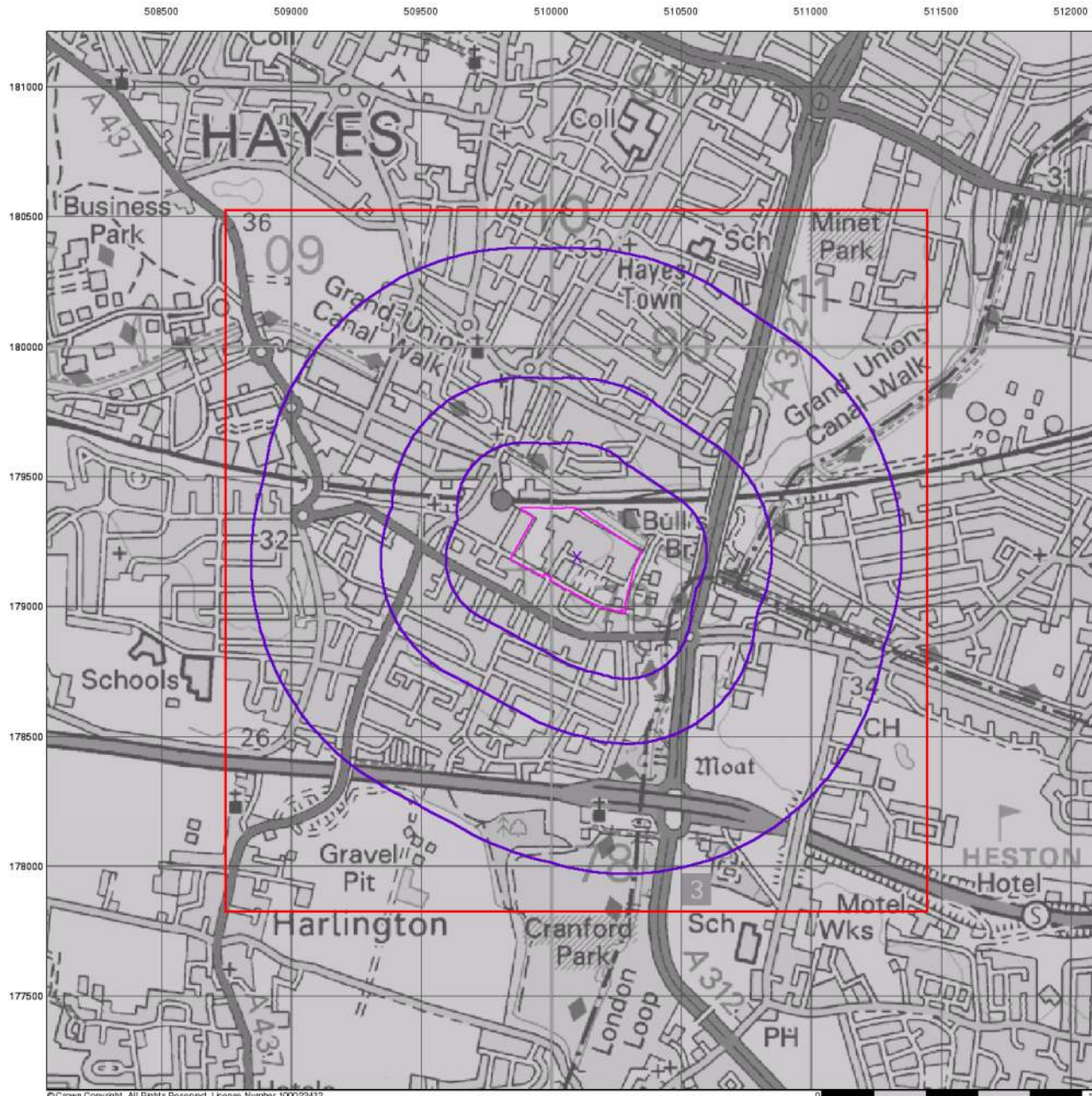
Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details

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0 1 km



## Bedrock Aquifer Designation

### General

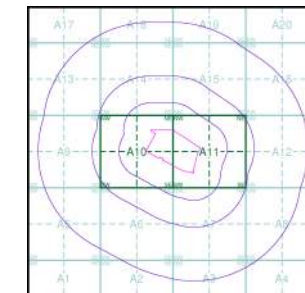
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

### Agency and Hydrological

#### Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

### Site Sensitivity Context Map - Slice A



### Order Details

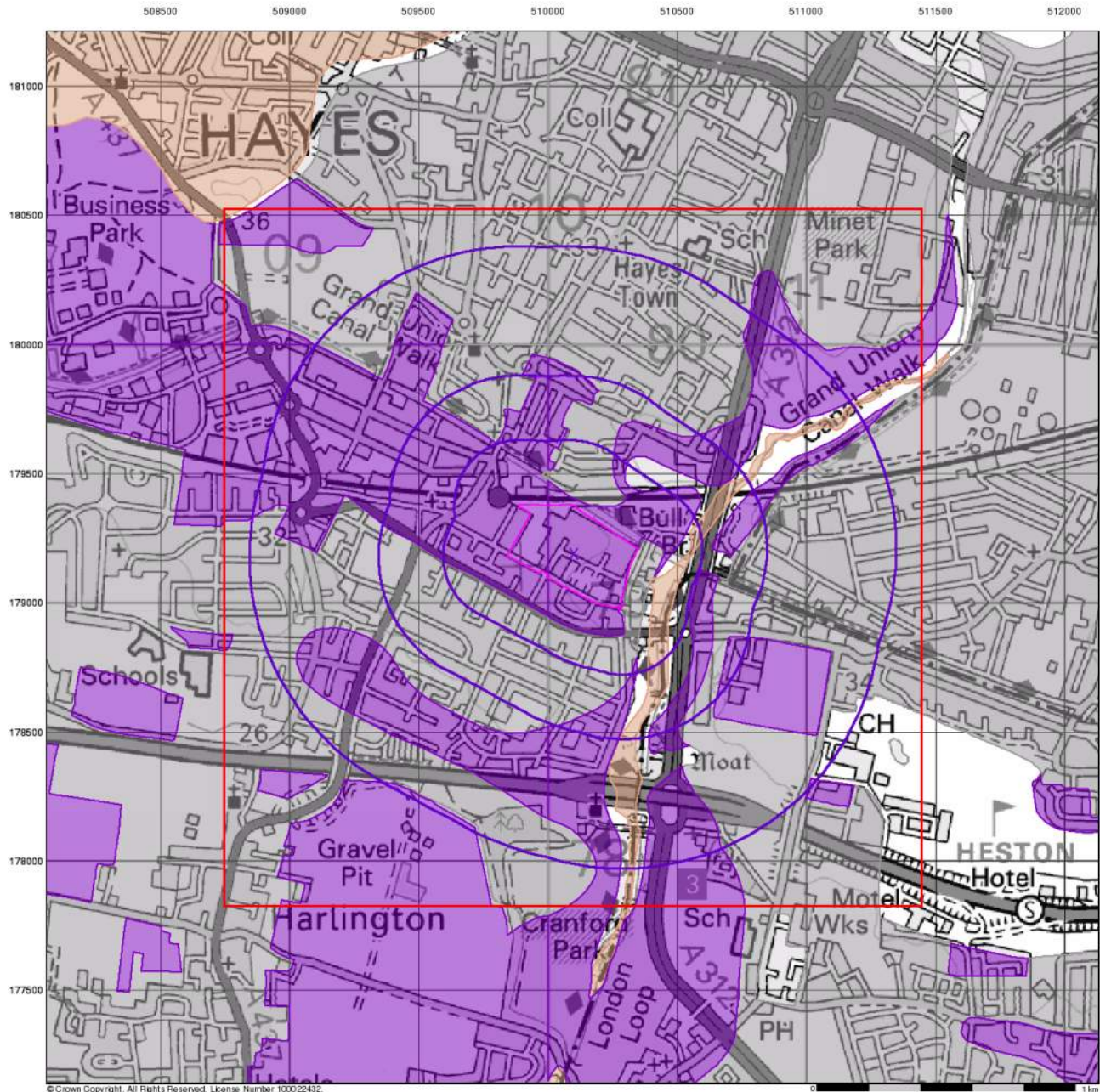
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 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details

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## Superficial Aquifer Designation

### General

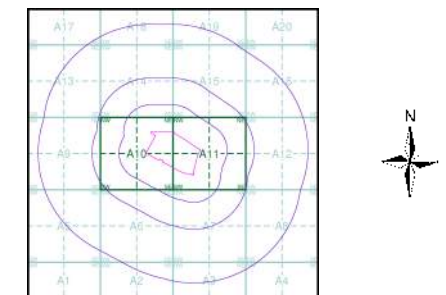
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

### Agency and Hydrological

#### Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

### Site Sensitivity Context Map - Slice A



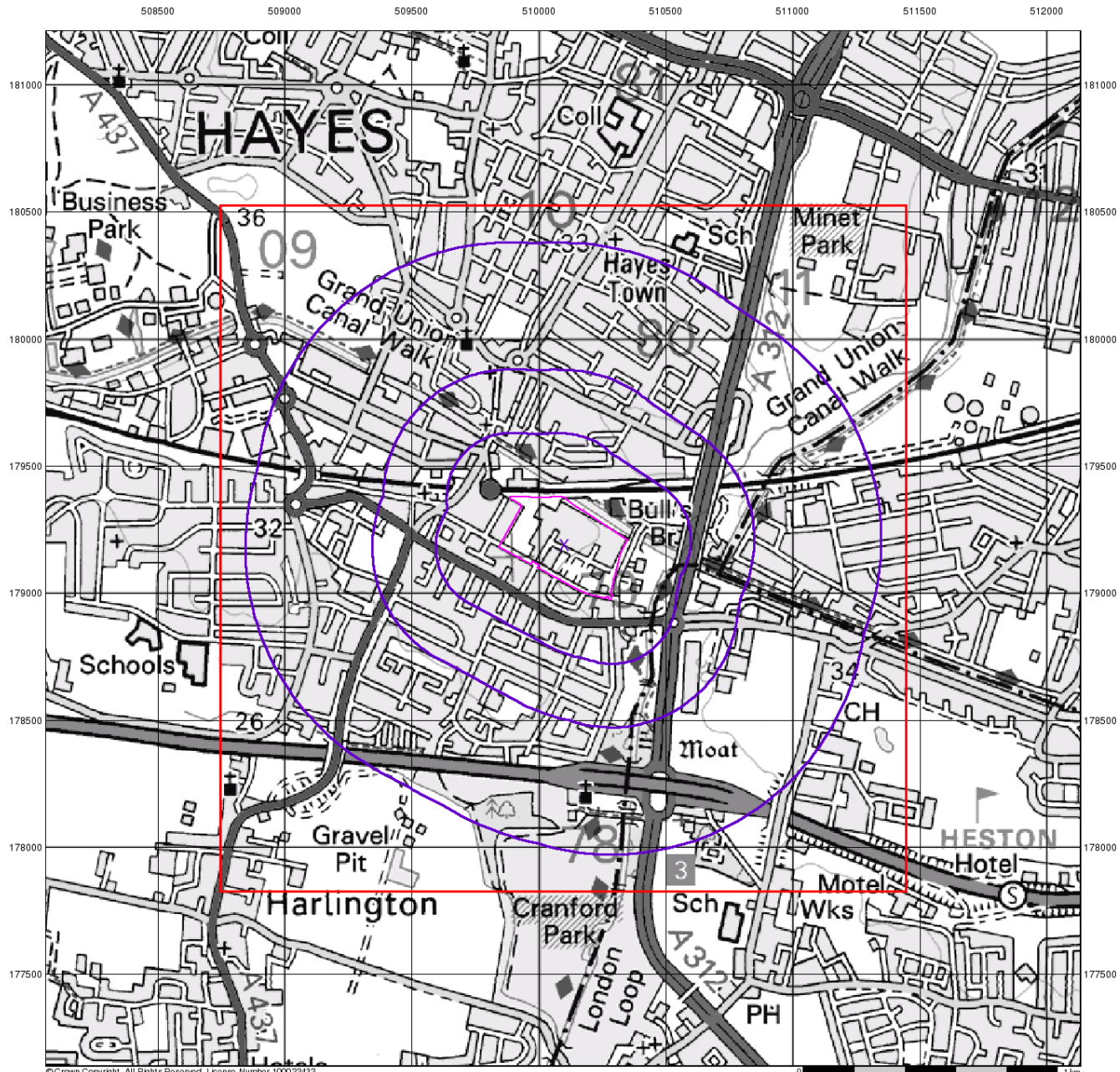
### Order Details

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details

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## Source Protection Zones

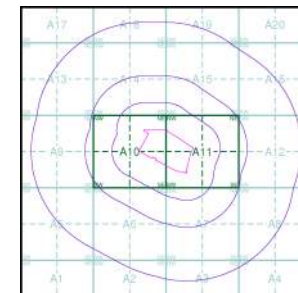
### General

- ◆ Specified Site
- Specified Buffer(s)
- ✕ Bearing Reference Point
- Slice
- Map ID

### Agency and Hydrological

- Source Protection Zone I
- Source Protection Zone II
- Source Protection Zone III
- Zone of Special Interest
- Source Protection Zone Borehole

### Site Sensitivity Context Map - Slice A



### Order Details

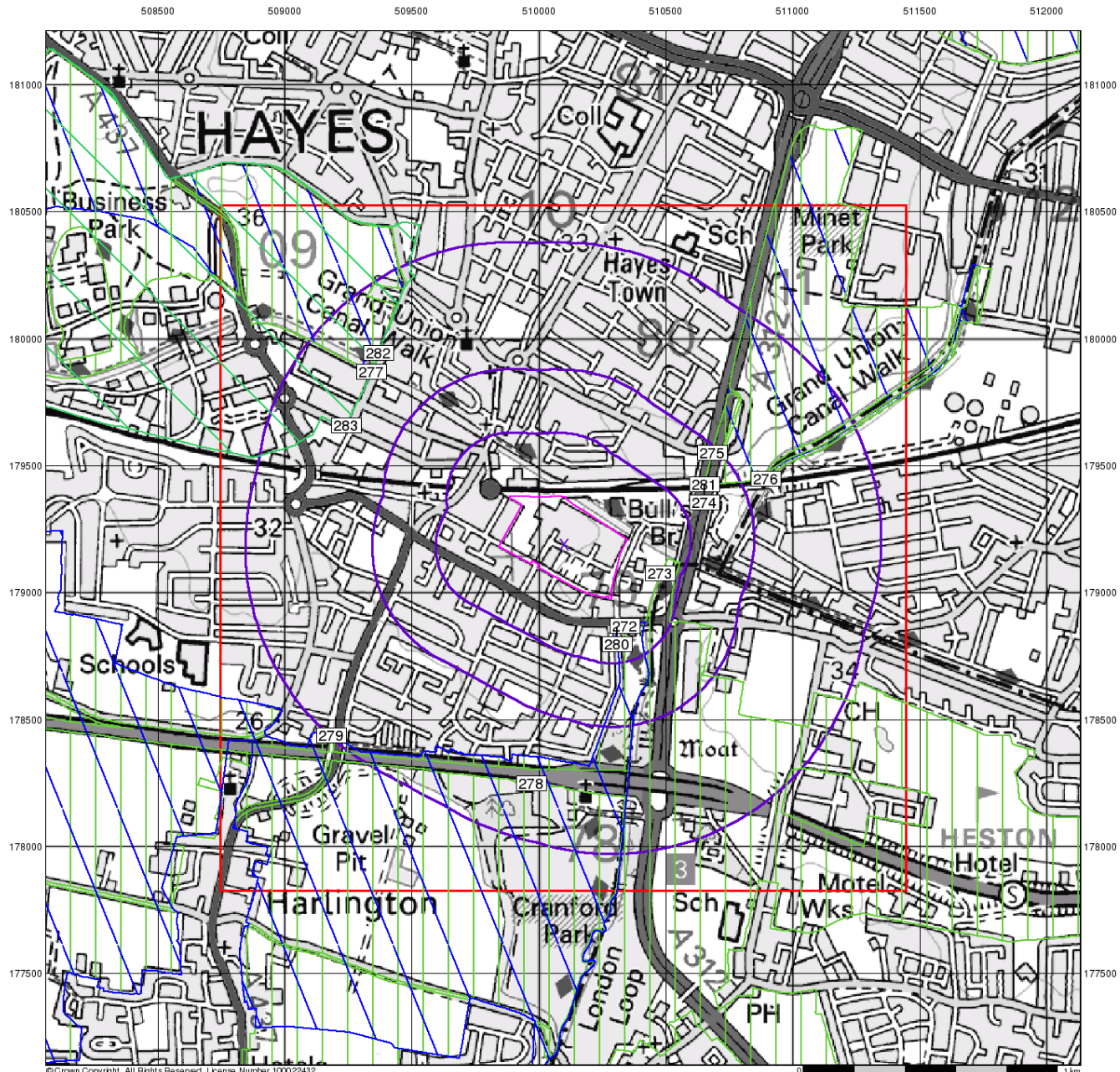
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 Customer Ref: GCU0124020  
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## Sensitive Land Uses

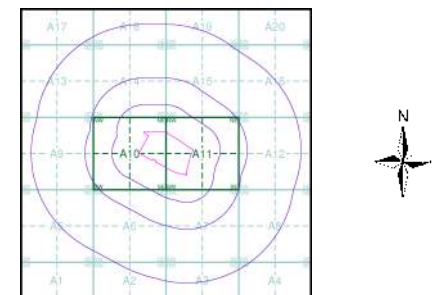
### General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

### Sensitive Land Uses

- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area

### Site Sensitivity Context Map - Slice A

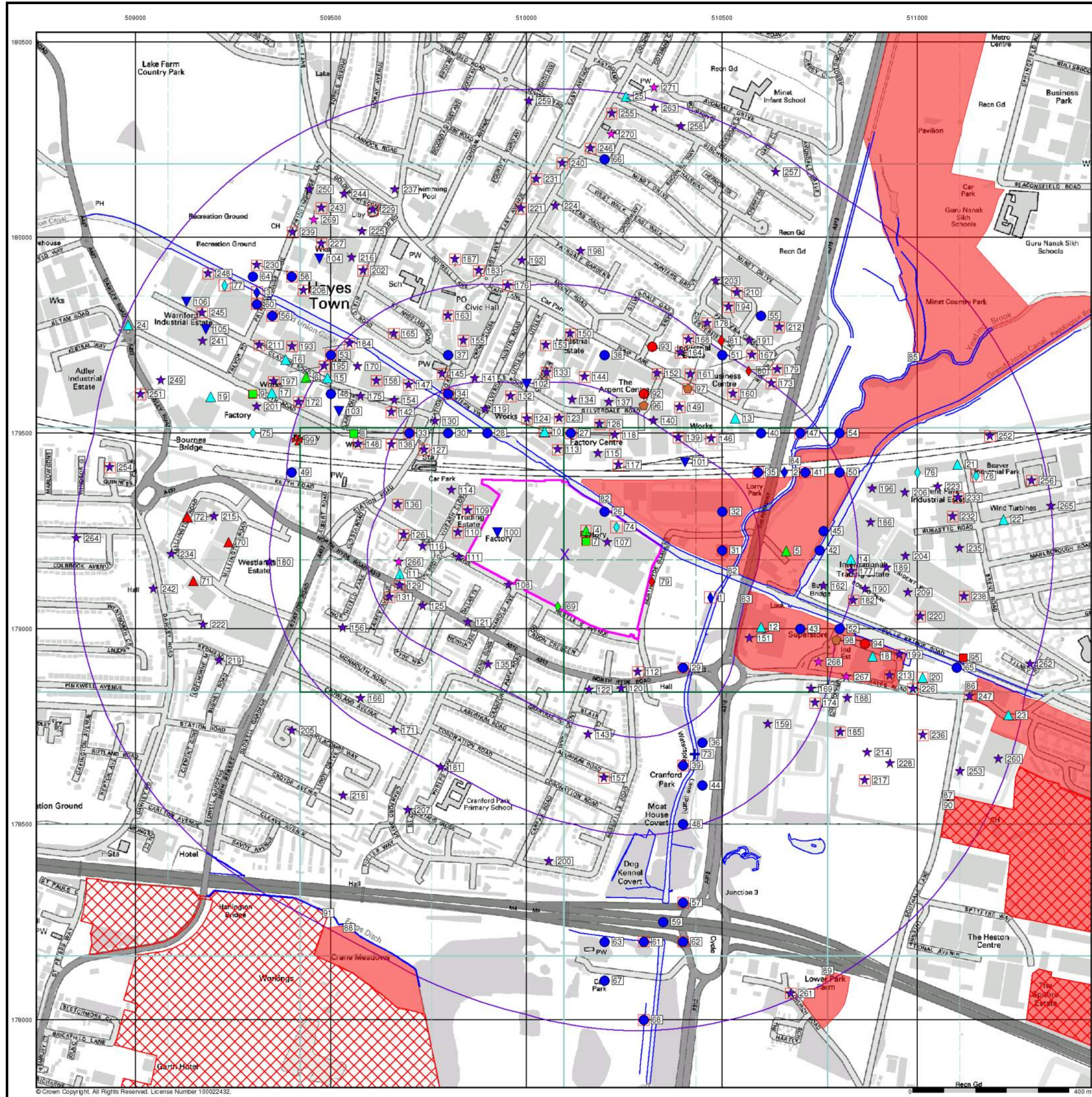


### Order Details

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 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
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 Search Buffer (m): 1000

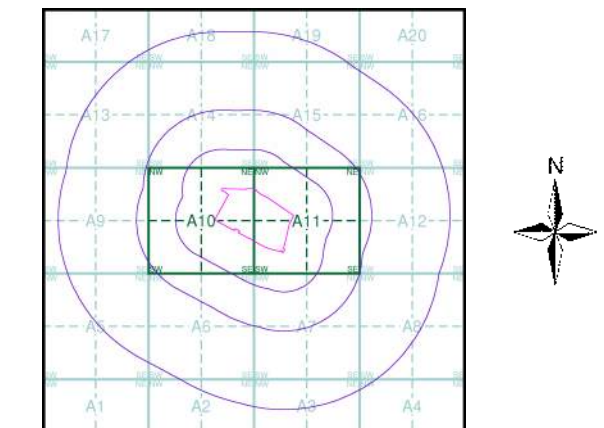
### Site Details

Nestle UK Ltd, Beverage Division, North Hyde Gardens, HAYES, Middlesex, UB3 4RF



- General**
- ★ Specified Site
  - Specified Buffer(s)
  - ✕ Bearing Reference Point
  - 8 Map ID
  - Several of Type at Location
- Agency and Hydrological**
- Contaminated Land Register Entry or Notice (Location)
  - ◊ Contaminated Land Register Entry or Notice
  - ▲ Discharge Consent
  - ▲ Enforcement or Prohibition Notice
  - ▲ Integrated Pollution Control
  - Integrated Pollution Prevention and Control
  - ▲ Local Authority Integrated Pollution Prevention and Control
  - ▲ Local Authority Pollution Prevention and Control Enforcement
  - Pollution Incident to Controlled Waters
  - ▲ Prosecution Relating to Authorised Processes
  - ▲ Prosecution Relating to Controlled Waters
  - ▲ Registered Radioactive Substance
  - + River Quality Sampling Point
  - Substantiated Pollution Incident Register
  - ◆ Water Abstraction
  - ◆ Water Industry Act Referral
  - ▼ River Network or Water Feature
  - + River Quality Sampling Point
  - Substantiated Pollution Incident Register
  - ◆ Water Abstraction
  - ◆ Water Industry Act Referral
- Waste**
- ▼ BGS Recorded Landfill Site (Location)
  - BGS Recorded Landfill Site
  - EA Historic Landfill (Buffered Point)
  - EA Historic Landfill (Polygon)
  - ▲ Integrated Pollution Control Registered Waste Site
  - Licensed Waste Management Facility (Landfill Boundary)
  - Licensed Waste Management Facility (Location)
  - Local Authority Recorded Landfill Site (Location)
  - Registered Landfill Site
  - Registered Landfill Site (Location)
  - Registered Landfill Site (Point Buffered to 100m)
  - Registered Landfill Site (Point Buffered to 250m)
  - Registered Waste Transfer Site (Location)
  - Registered Waste Transfer Site
  - Registered Waste Treatment or Disposal Site (Location)
  - Registered Waste Treatment or Disposal Site
- Hazardous Substances**
- ✕ COMAH Site
  - ✕ Explosive Site
  - ✕ NIHS Site
  - ✕ Planning Hazardous Substance Consent
  - ✕ Planning Hazardous Substance Enforcement
- Geological**
- ▼ BGS Recorded Mineral Site
- Industrial Land Use**
- ★ Contemporary Trade Directory Entry
  - ★ Fuel Station Entry

**Site Sensitivity Map - Slice A**

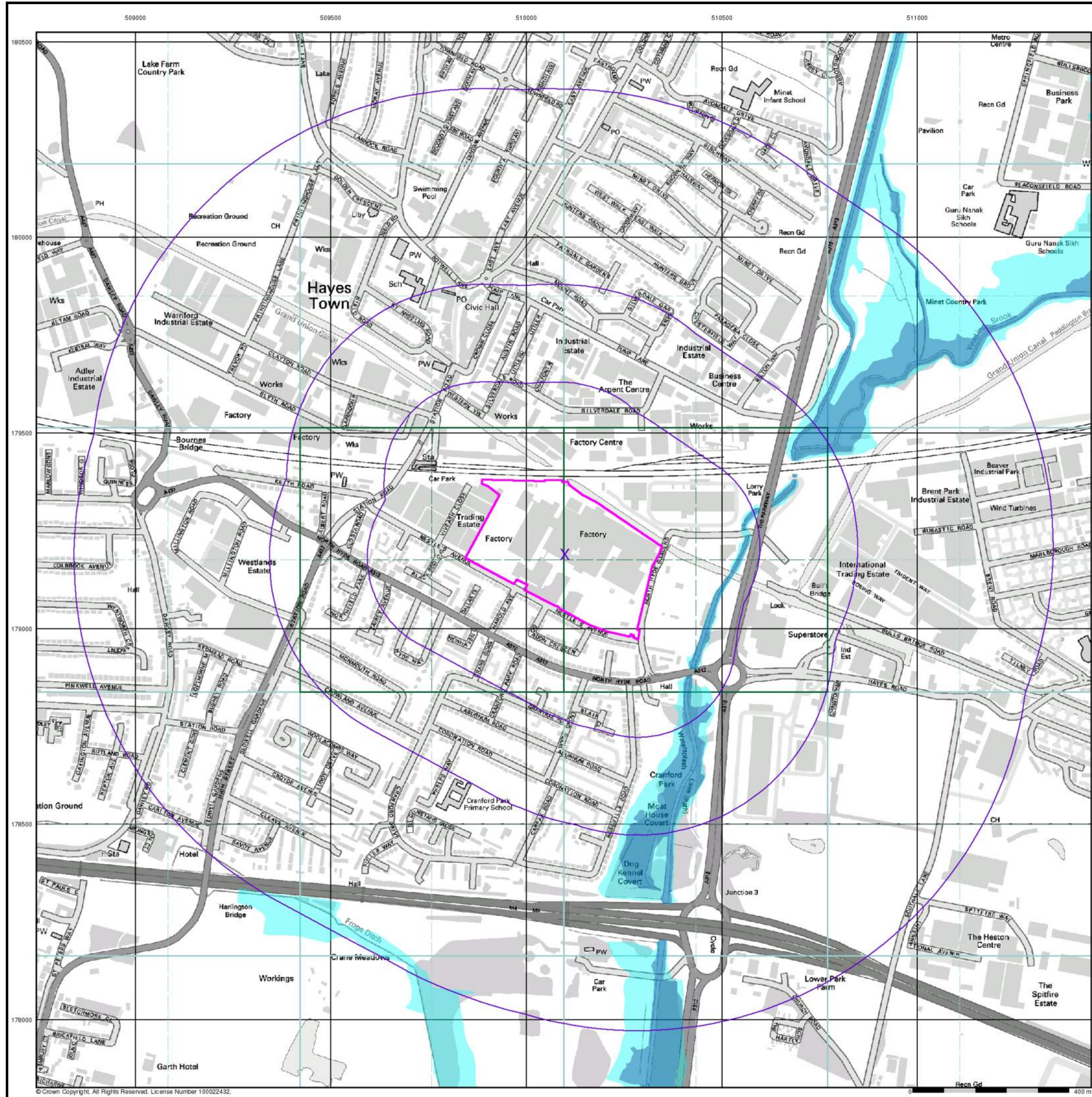










**Order Details**

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

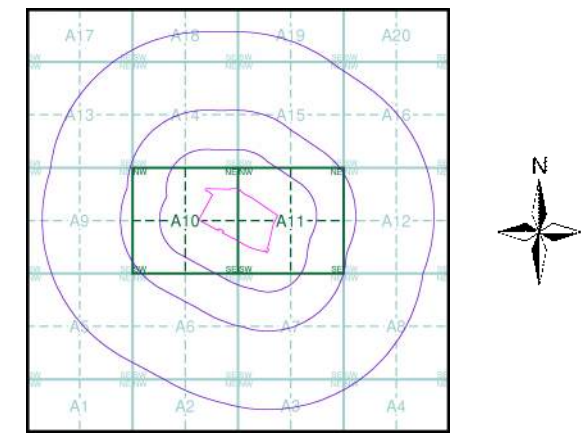
**Site Details**

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 HAYES, Middlesex, UB3 4RF



- General**
-  Specified Site
  -  Specified Buffer(s)
  -  Bearing Reference Point
- Agency and Hydrological (Flood)**
-  Extreme Flooding from Rivers or Sea without Defences (Zone 2)
  -  Flooding from Rivers or Sea without Defences (Zone 3)
  -  Area Benefiting from Flood Defence
  -  Flood Water Storage Areas
  -  Flood Defence

**Flood Map - Slice A**

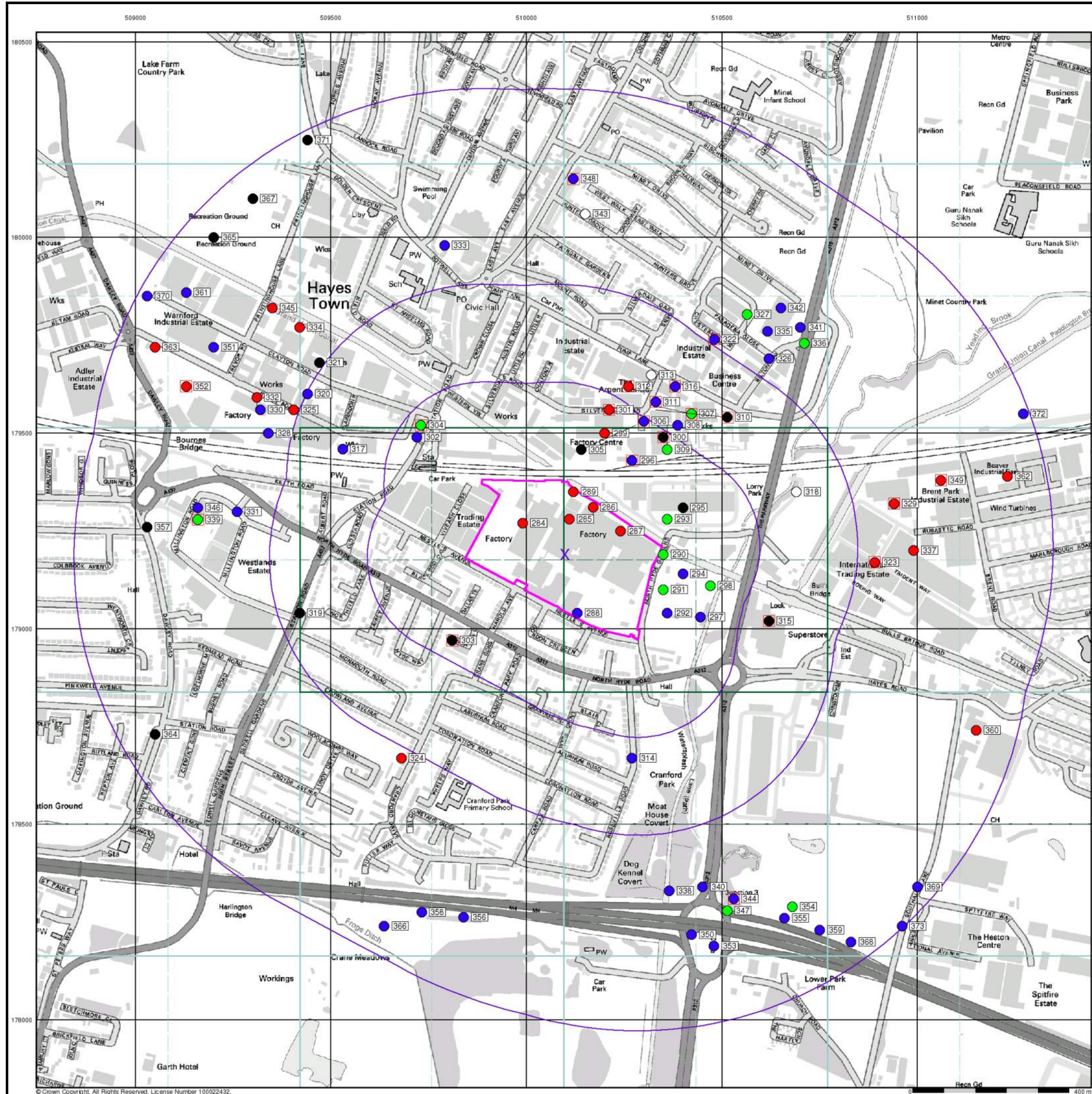


**Order Details**

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

**Site Details**

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**General**

- ◆ Specified Site
- Specified Buffer(s)
- ✕ Bearing Reference Point
- Map ID
- Several of Type at Location

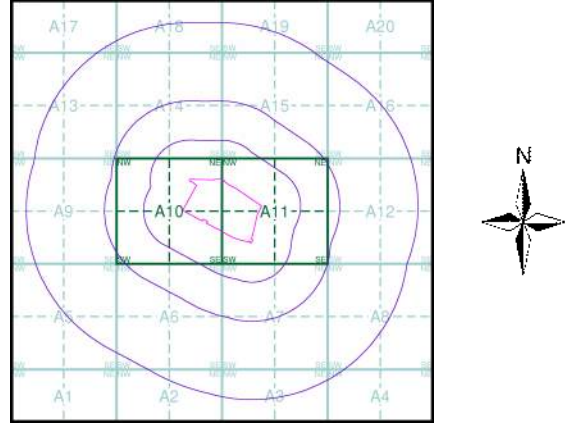
**Agency and Hydrological (Boreholes)**

- BGS Borehole Depth 0 - 10m
- BGS Borehole Depth 10 - 30m
- BGS Borehole Depth 30m +
- Confidential
- Other

For Borehole information please refer to the Borehole .csv file which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of [www.envirocheck.co.uk](http://www.envirocheck.co.uk).

**Borehole Map - Slice A**



**Order Details**

Order Number: 48644303\_1\_1  
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 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

**Site Details**

Nestle UK Ltd, Beverage Division, North Hyde Gardens, HAYES, Middlesex, UB3 4RF

# Historical Mapping Legends

## Ordnance Survey County Series 1:10,560

- Gravel Pit
- Sand Pit
- Other Pits
- Quarry
- Shingle
- Orchard
- Osiers
- Reeds
- Marsh
- Mixed Wood
- Deciduous
- Brushwood
- Fir
- Furze
- Rough Pasture
- Arrow denotes flow of water
- Trigonometrical Station
- Site of Antiquities
- Bench Mark
- Pump, Guide Post, Signal Post
- Well, Spring, Boundary Post
- 285** Surface Level
- Sketched Contour
- Instrumental Contour
- Main Roads
- Minor Roads
- Sunken Road
- Raised Road
- Road over Railway
- Railway over River
- Railway over Road
- Level Crossing
- Road over River or Canal
- Road over Stream
- Road over Stream
- County Boundary (Geographical)
- County & Civil Parish Boundary
- Administrative County & Civil Parish Boundary
- County Borough Boundary (England)
- County Burgh Boundary (Scotland)
- Rural District Boundary
- Civil Parish Boundary

## Ordnance Survey Plan 1:10,000

- Chalk Pit, Clay Pit or Quarry
- Gravel Pit
- Sand Pit
- Disused Pit or Quarry
- Refuse or Slag Heap
- Lake, Loch or Pond
- Dunes
- Boulders
- Coniferous Trees
- Non-Coniferous Trees
- Orchard
- Scrub
- Coppice
- Bracken
- Heath
- Rough Grassland
- Marsh
- Reeds
- Saltings
- Building
- Glasshouse
- Sloping Masonry
- Pylon
- Electricity Transmission Line
- Pole
- Cutting
- Embankment
- Standard Gauge Multiple Track
- Standard Gauge Single Track
- Siding, Tramway or Mineral Line
- Narrow Gauge
- Geographical County
- Administrative County, County Borough or County of City
- Municipal Borough, Urban or Rural District, Burgh or District Council
- Borough, Burgh or County Constituency  
Shown only when not coincident with other boundaries
- Civil Parish  
Shown alternately when coincidence of boundaries occurs
- BP, BS Boundary Post or Stone
- Ch Church
- CH Club House
- F E Sta Fire Engine Station
- FB Foot Bridge
- Fn Fountain
- GP Guide Post
- MP Mile Post
- MS Mile Stone
- Pol Sta Police Station
- PO Post Office
- PC Public Convenience
- PH Public House
- SB Signal Box
- Spr Spring
- TCB Telephone Call Box
- TCP Telephone Call Post
- W Well

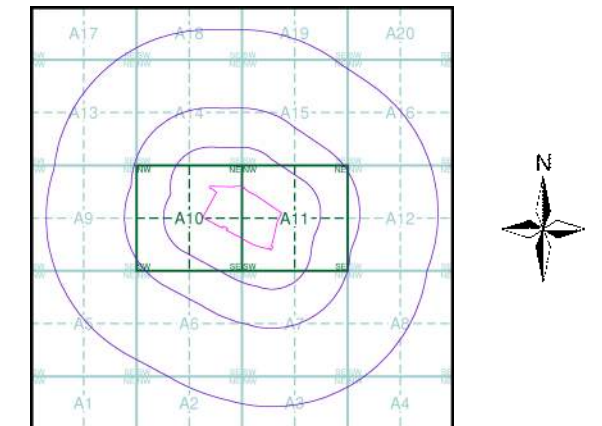
## 1:10,000 Raster Mapping

- Gravel Pit
- Rock
- Boulders
- Shingle
- Sand
- Slopes
- General detail
- Overhead detail
- Multi-track railway
- County boundary (England only)
- District, Unitary, Metropolitan, London Borough boundary
- Area of wooded vegetation
- Non-coniferous trees (scattered)
- Coniferous trees (scattered)
- Orchard
- Rough Grassland
- Scrub
- Water feature
- MHW(S) Mean high water (springs)
- Telephone line (where shown)
- Bench mark (where shown)
- Point feature (e.g. Guide Post or Mile Stone)
- Site of (antiquity)
- General Building
- Refuse tip or slag heap
- Rock (scattered)
- Boulders (scattered)
- Mud
- Sand Pit
- Top of cliff
- Underground detail
- Narrow gauge railway
- Single track railway
- Civil, parish or community boundary
- Constituency boundary
- Non-coniferous trees
- Coniferous trees
- Positioned tree
- Coppice or Osiers
- Heath
- Marsh, Salt Marsh or Reeds
- Flow arrows
- MLW(S) Mean low water (springs)
- Electricity transmission line (with poles)
- Triangulation station
- Pylon, flare stack or lighting tower
- Glasshouse
- Important Building

## Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Middlesex	1:10,560	1868 - 1869	3
Surrey	1:10,560	1871	4
Buckinghamshire	1:10,560	1881	5
Middlesex	1:10,560	1897	6
Buckinghamshire	1:10,560	1900	7
Middlesex	1:10,560	1920	8
Buckinghamshire	1:10,560	1932	9
Middlesex	1:10,560	1932 - 1935	10
Middlesex	1:10,560	1935	11
Middlesex	1:10,560	1938	12
Middlesex	1:10,560	1938	13
Historical Aerial Photography	1:10,560	1948	14
Historical Aerial Photography	1:10,560	1948	15
Ordnance Survey Plan	1:10,000	1960	16
Ordnance Survey Plan	1:10,000	1965 - 1966	17
Ordnance Survey Plan	1:10,000	1970 - 1975	18
Ordnance Survey Plan	1:10,000	1975 - 1977	19
Ordnance Survey Plan	1:10,000	1985 - 1989	20
London	1:25,000	1985	21
Ordnance Survey Plan	1:10,000	1990 - 1995	22
10K Raster Mapping	1:10,000	2006	23
10K Raster Mapping	1:10,000	2013	24

## Historical Map - Slice A



## Order Details

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

## Site Details

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF

# Russian Military Mapping Legends

## 1:5,000 and 1:10,000 mapping

a. Not drawn to scale b. Drawn to scale

	Government and Administrative Buildings		Military and Industrial Buildings
	Military and Communication Areas		Subway Entrance
	Fireproof Building		Prominent Fireproof Building
	Non-fireproof Building		Non-fireproof Building (non-dwelling)
	Factory, mill, and flour mill, with chimneys		Factory, mill, and flour mill, without chimneys
	Power Station, drawn to scale		Hydroelectric Power Station
	Radio Station, drawn to scale		Telephone Station, drawn to scale
	Abandoned Open-pit Mine or Quarry		Open-pit Salt Mine
	Pit		Oil Deposit or Well
	Oil Seepage		Natural Gas Tank
	Tailings Pile		Fuel Storage Tanks
	Bench Mark		Drill Hole
	Burial Mound		Triangulation Point on Burial Mound
	Single-track Railroad		Double-track Railroad
	Small Bridge		Tunnel
	Pipe (Culvert)		Railroad and Station Building
	Coniferous Forest		Deciduous Forest
	Mixed Forest		Lawns
	Citrus Orchard		Wet Ground
	Scattered Vegetation		

**243,8** Values for prominent elevations  
**186.0** Numbers for spot elevations, depth soundings, contour lines, etc.  
**0,2** Velocity of the current, width of river bed, depth of river  
**180/12** Fractional terms: length and capacity of bridges; depth of fords and condition of the river bottom; height of forest and the diameter of trees

### Russian Alphabet (For reference and phonetic interpretation of map text)

<b>А а (A)</b>	<b>З з (Z)</b>	<b>П п (P)</b>	<b>Ч ч (CH)</b>
<b>Б б (B)</b>	<b>И и (I)</b>	<b>Р р (R)</b>	<b>Ш ш (SH)</b>
<b>В в (V)</b>	<b>Й й (Y)</b>	<b>С с (S)</b>	<b>Щ щ (SHCH)</b>
<b>Г г (G)</b>	<b>К к (K)</b>	<b>Т т (T)</b>	<b>Ъ (-)</b>
<b>Д д (D)</b>	<b>Л л (L)</b>	<b>У у (U)</b>	<b>Ы (Y)</b>
<b>Е е (E)</b>	<b>М м (M)</b>	<b>Ф ф (F)</b>	<b>Ь (')</b>
<b>Ё ё (YO)</b>	<b>Н н (N)</b>	<b>Х х (KH)</b>	<b>Э э (E)</b>
<b>Ж ж (ZH)</b>	<b>О о (O)</b>	<b>Ц ц (TS)</b>	<b>Ю ю (YU or IU)</b>
			<b>Я я (YA or IA)</b>

## 1:25,000 mapping

a. Not drawn to scale b. Drawn to scale

	Government and Administrative Buildings		Military and Industrial Buildings
	Military and Communication Areas		Subway Entrance
	Partly Demolished Buildings		Demolished Buildings
	Built-Up Area with Fireproof Buildings Predominant		Built-Up Area with Non-Fireproof Buildings Predominant
	Individual Fireproof Building		Prominent Industrial Building
	Individual Dwelling, Fireproof		Ruins of an Individual Dwelling
	Factory or Mill Chimney		Factory or Mill with Chimney
	Factory or Mill without Chimney		Mine or Open Pit Mine
	Operating Shaft or Mine		Non-Operating Shaft or Mine
	Salt Mine		Tailings Pile
	Pit		Stone Quarry
	Gas Pump or Service Station		Fuel Storage or Natural Gas Tank
	Oil or Natural Gas Derrick		Small Hydroelectric Power Station
	Power Station		Transformer Station
	Cemetery		Burial Mound (height in metres)
	Triangulation Point on Burial Mound		Triangulation Point
	Bench Mark		Telegraph Office
	Telephone Station		Radio Station
	Radio Tower		Airfield or Seaplane Base
	Landing Strip		Cut
	Fill		Km Post
	Plantings		Width of Road
	Steep Grade		Highway under Construction
	Improved Dirt Road (former truck road)		Small Bridge
	Pipe (Culvert)		Tunnel
	Dismantled Railroad		Double-track Railroad with First Class Station
	Railroad Under Construction		Shore Embankment
	River or Ditch with Embankment		Water Gauge
	Direction and velocity of current		Water Level Mark
	Well		Spring
	Water Reservoir or Rain Water Pit		Isobath with value
	Contour Line and Value		Half Contour Line
	Spot Elevation Value		Coniferous
	Deciduous		Mixed
	Scrub		

## Key to Numbers on Mapping

### TQ07\_London

No.	Description
74	Factory (Artillery)

### TQ08\_London

No.	Description
278	Warehouses (Use Unknown)

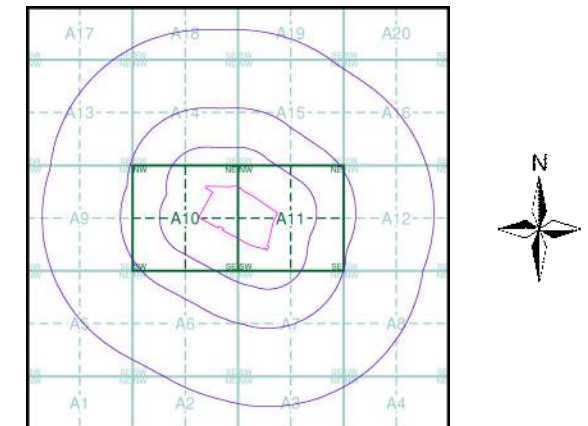
### TQ17\_London

No.	Description
157	Factories (Radio Electronics And Electro Technical)

## Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Middlesex	1:10,560	1868 - 1869	3
Surrey	1:10,560	1871	4
Buckinghamshire	1:10,560	1881	5
Middlesex	1:10,560	1897	6
Buckinghamshire	1:10,560	1900	7
Middlesex	1:10,560	1920	8
Buckinghamshire	1:10,560	1932	9
Middlesex	1:10,560	1932 - 1935	10
Middlesex	1:10,560	1935	11
Middlesex	1:10,560	1938	12
Middlesex	1:10,560	1938	13
Historical Aerial Photography	1:10,560	1948	14
Historical Aerial Photography	1:10,560	1948	15
Ordnance Survey Plan	1:10,000	1960	16
Ordnance Survey Plan	1:10,000	1965 - 1966	17
Ordnance Survey Plan	1:10,000	1970 - 1975	18
Ordnance Survey Plan	1:10,000	1975 - 1977	19
Ordnance Survey Plan	1:10,000	1985 - 1989	20
London	1:25,000	1985	21
Ordnance Survey Plan	1:10,000	1990 - 1995	22
10K Raster Mapping	1:10,000	2006	23
10K Raster Mapping	1:10,000	2013	24

## Russian Map - Slice A

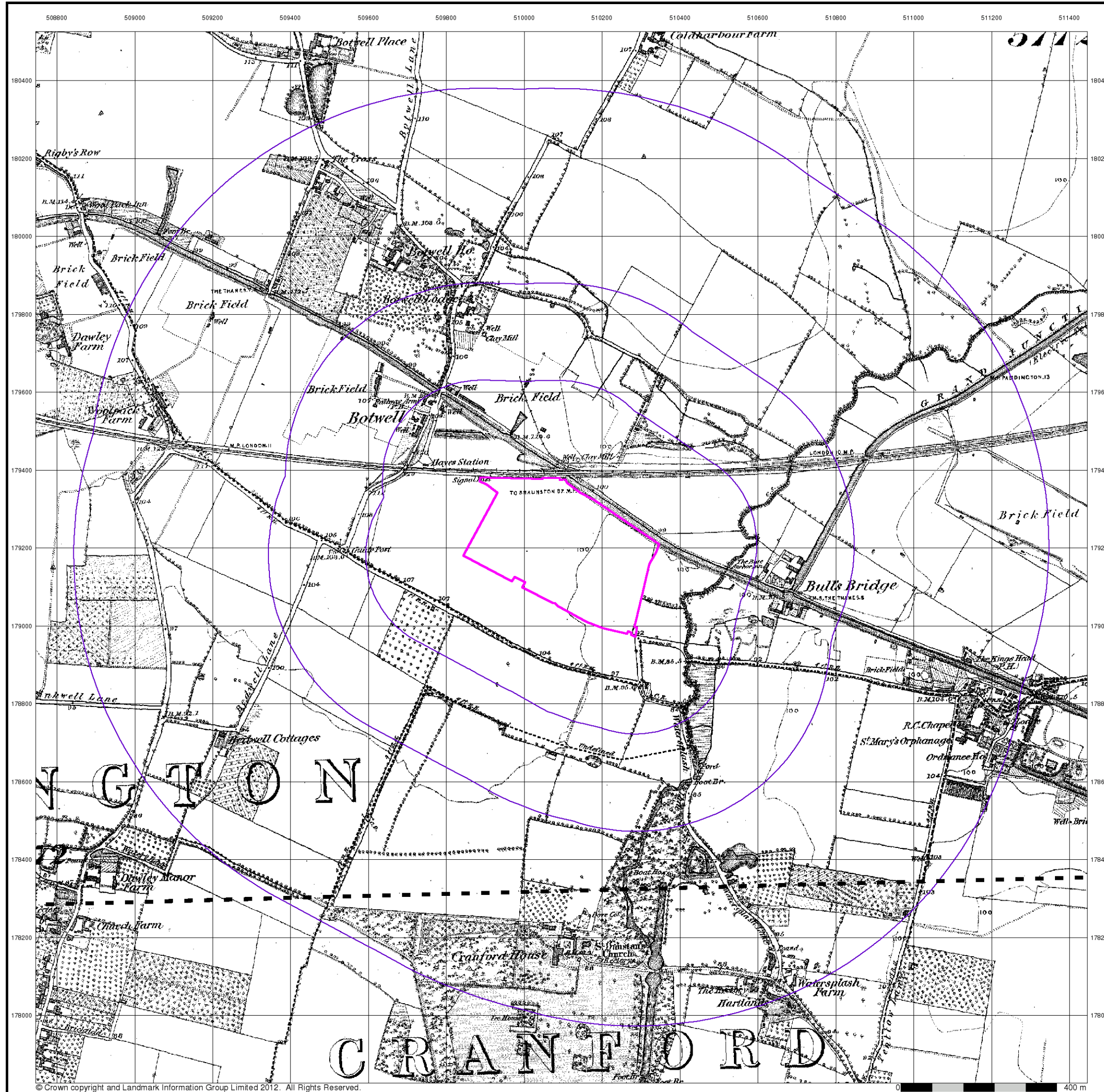


## Order Details

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

## Site Details

Nestle UK Ltd, Beverage Division, North Hyde Gardens, HAYES, Middlesex, UB3 4RF



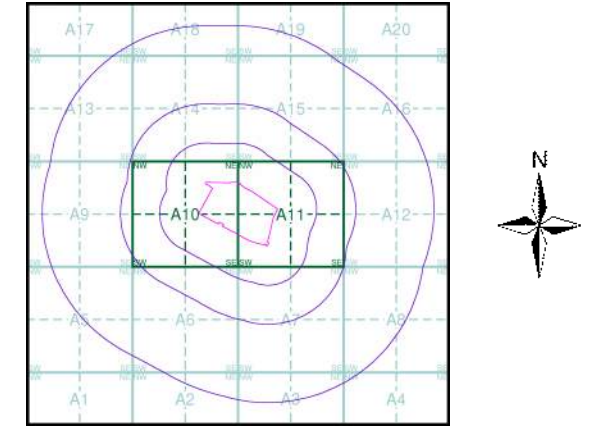
**Middlesex**  
**Published 1868 - 1869**  
**Source map scale - 1:10,560**

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

**Map Name(s) and Date(s)**

01500	1868	1:10,560
02000	1869	1:10,560

**Historical Map - Slice A**



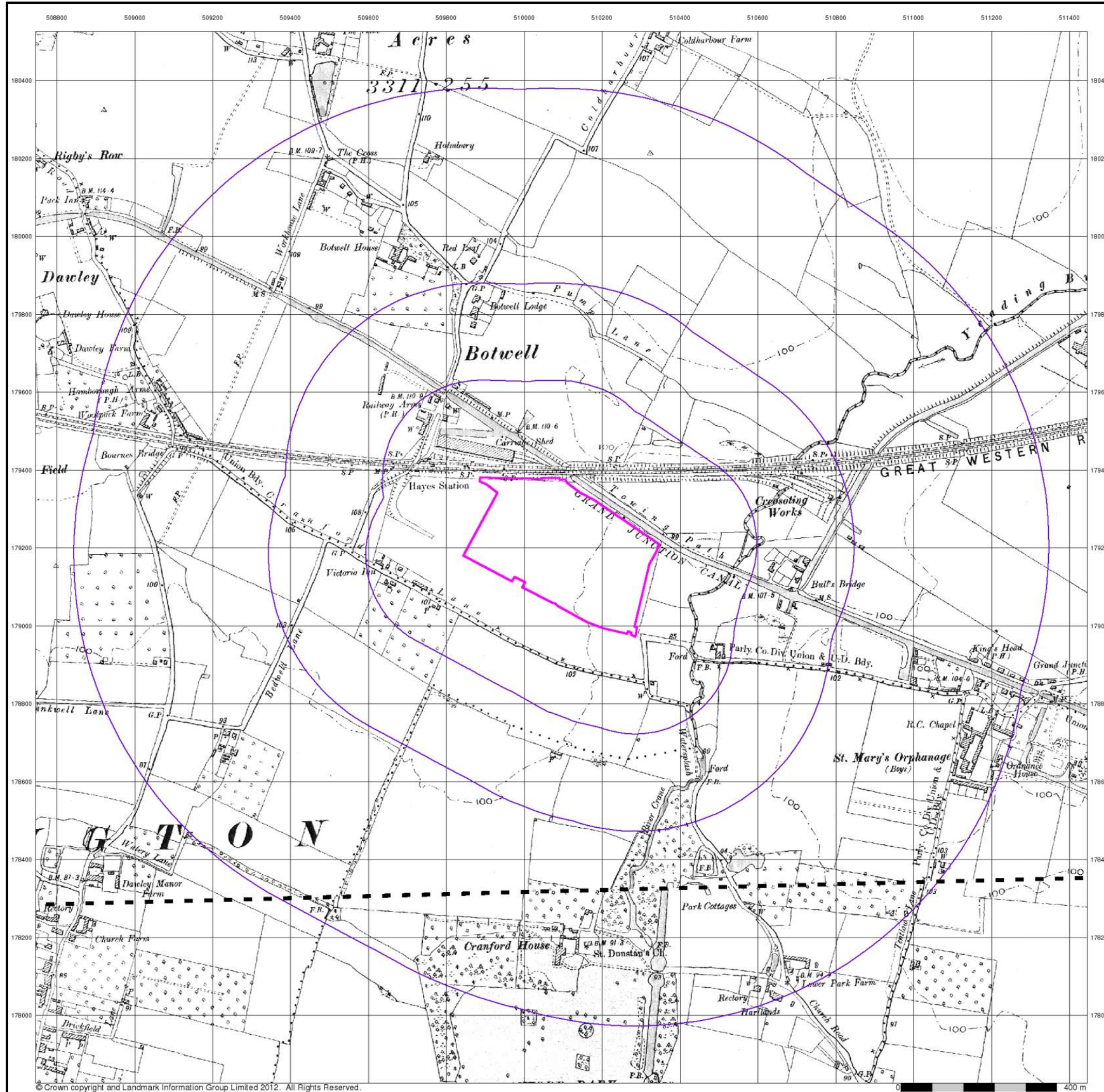
**Order Details**

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

**Site Details**

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF





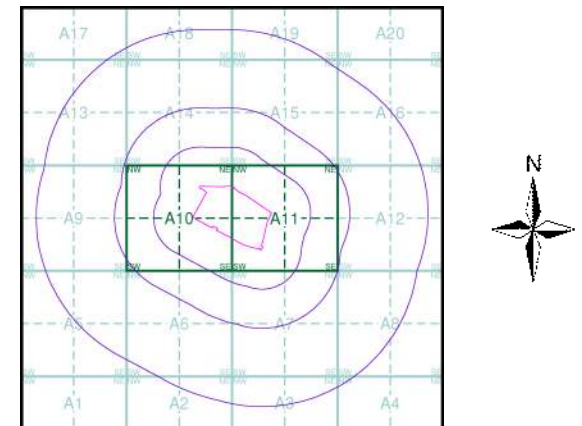
**Middlesex**  
**Published 1897**  
**Source map scale - 1:10,560**

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

**Map Name(s) and Date(s)**

015SW	1897	1:10,560
020NW	1897	1:10,560

**Historical Map - Slice A**

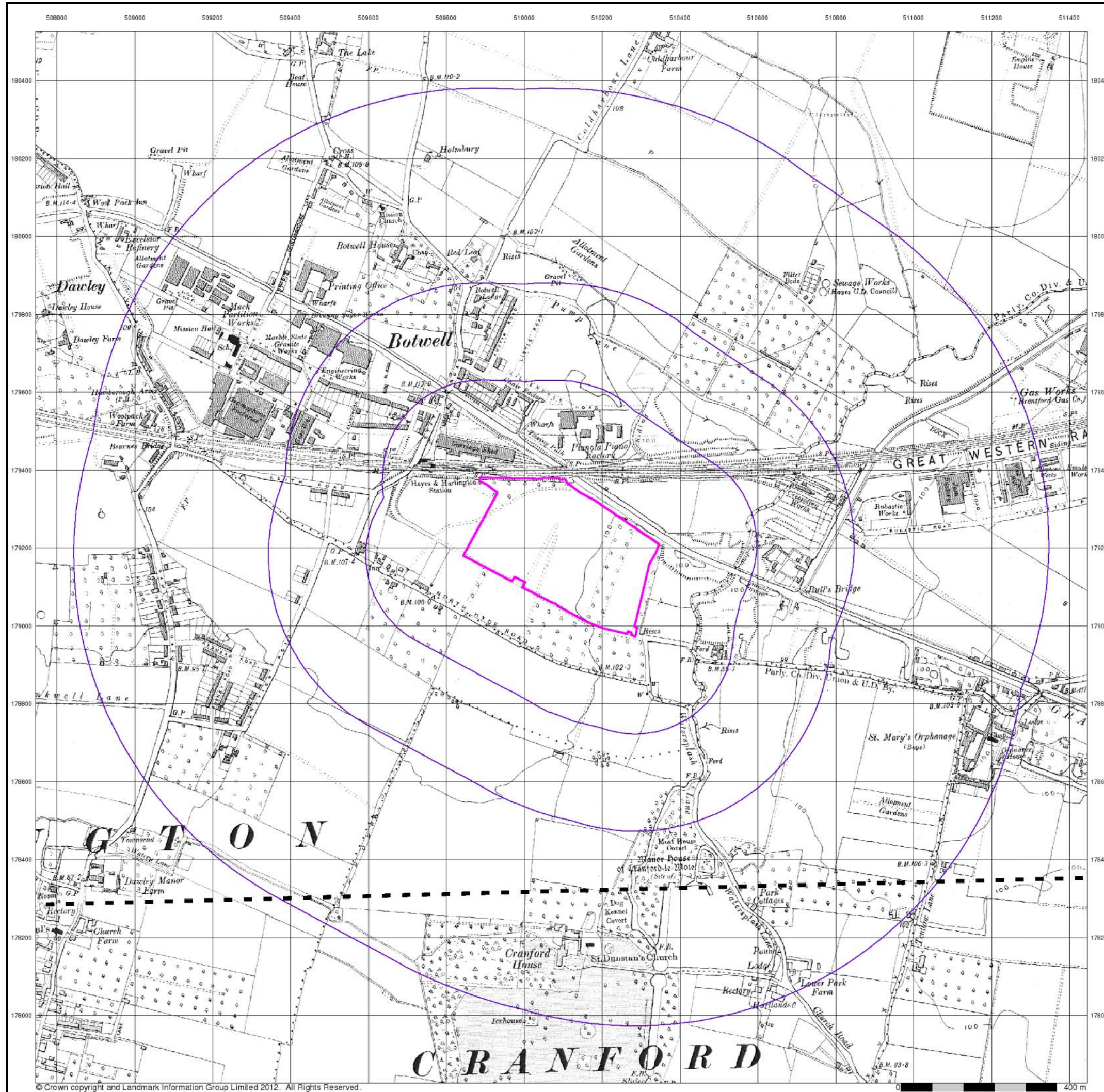


**Order Details**

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

**Site Details**

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF



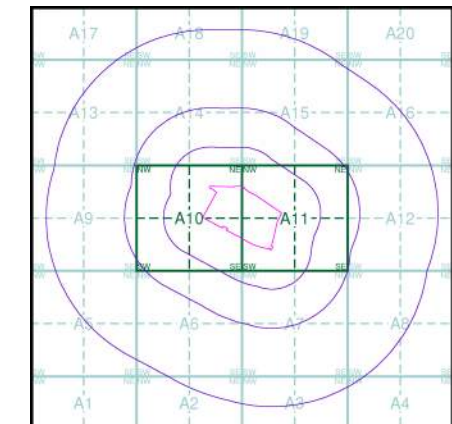
**Middlesex**  
**Published 1920**  
**Source map scale - 1:10,560**

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

**Map Name(s) and Date(s)**

015SW	1920	1:10,560
020NW	1920	1:10,560

**Historical Map - Slice A**

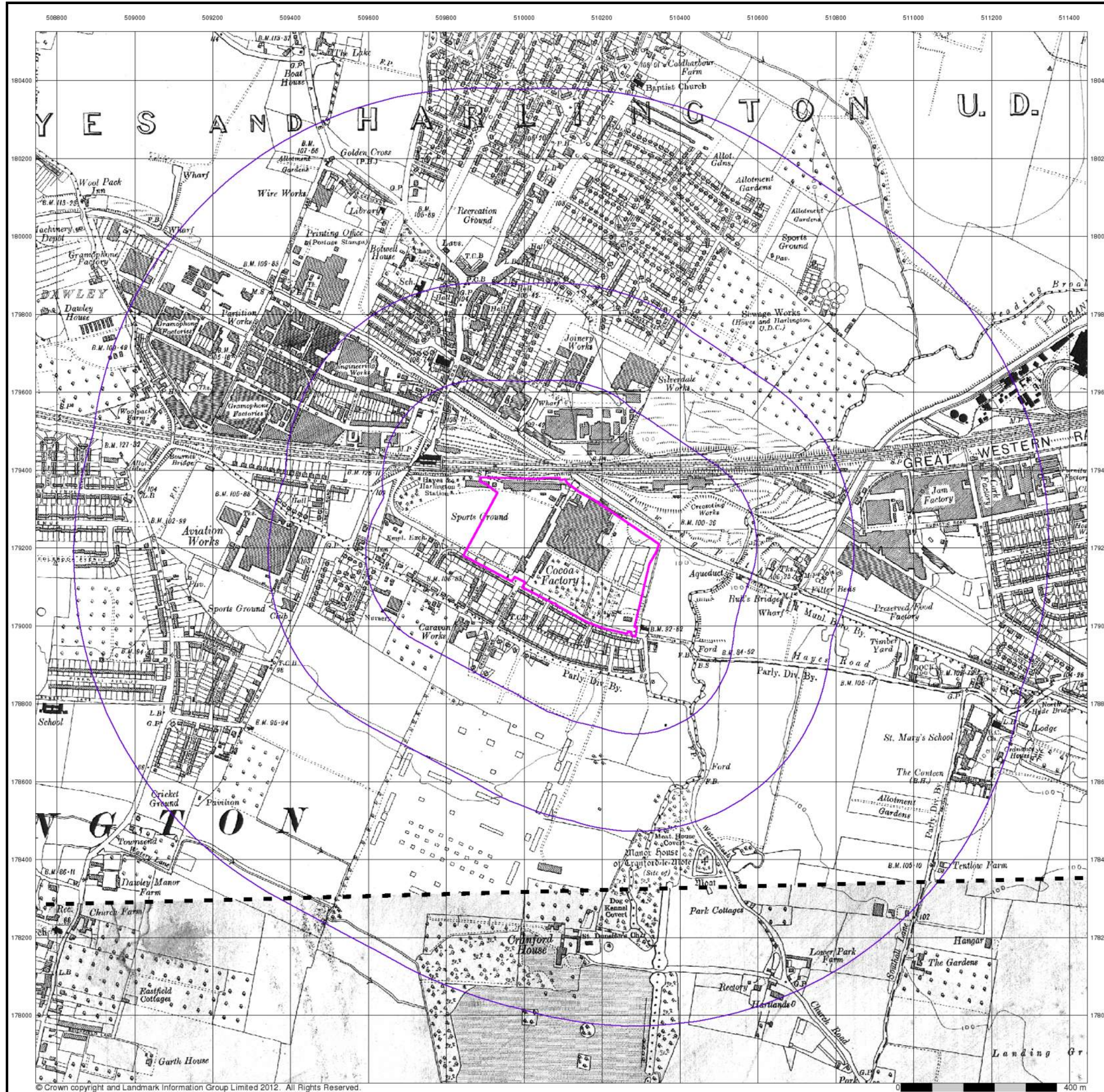


**Order Details**

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

**Site Details**

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF



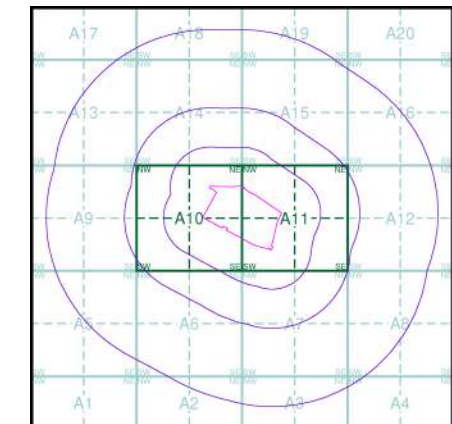
**Middlesex**  
**Published 1932 - 1935**  
**Source map scale - 1:10,560**

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

**Map Name(s) and Date(s)**

015SW	1935	1:10,560
020NW	1932	1:10,560

**Historical Map - Slice A**



**Order Details**

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

**Site Details**

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF

## Historical Aerial Photography

Published 1948

Source map scale - 1:10,560

The Historical Aerial Photos were produced by the Ordnance Survey at a scale of 1:1,250 and 1:10,560 from Air Force photography. They were produced between 1944 and 1951 as an interim measure, pending preparation of conventional mapping, due to post war resource shortages. New security measures in the 1950's meant that every photograph was re-checked for potentially unsafe information with security sites replaced by fake fields or clouds. The original editions were withdrawn and only later made available after a period of fifty years although due to the accuracy of the editing, without viewing both revisions it is not easy to spot the edits. Where available Landmark have included both revisions.

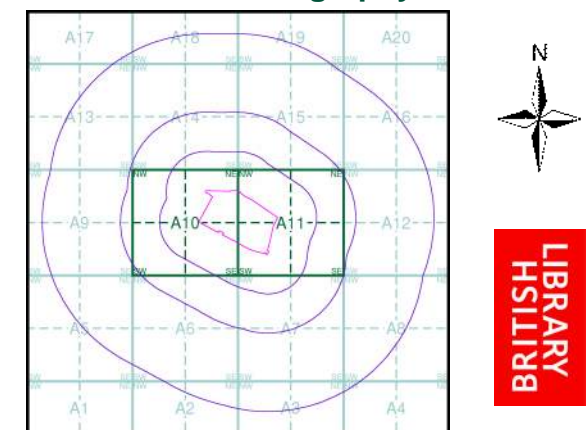
© Landmark Information Group and/or Data Suppliers 2010.

### Map Name(s) and Date(s)

TO08SE	TO18SW
1948	1948
1:10,560	1:10,560

TO07NE	TO17NW
1948	1948
1:10,560	1:10,560

### Historical Aerial Photography - Slice A

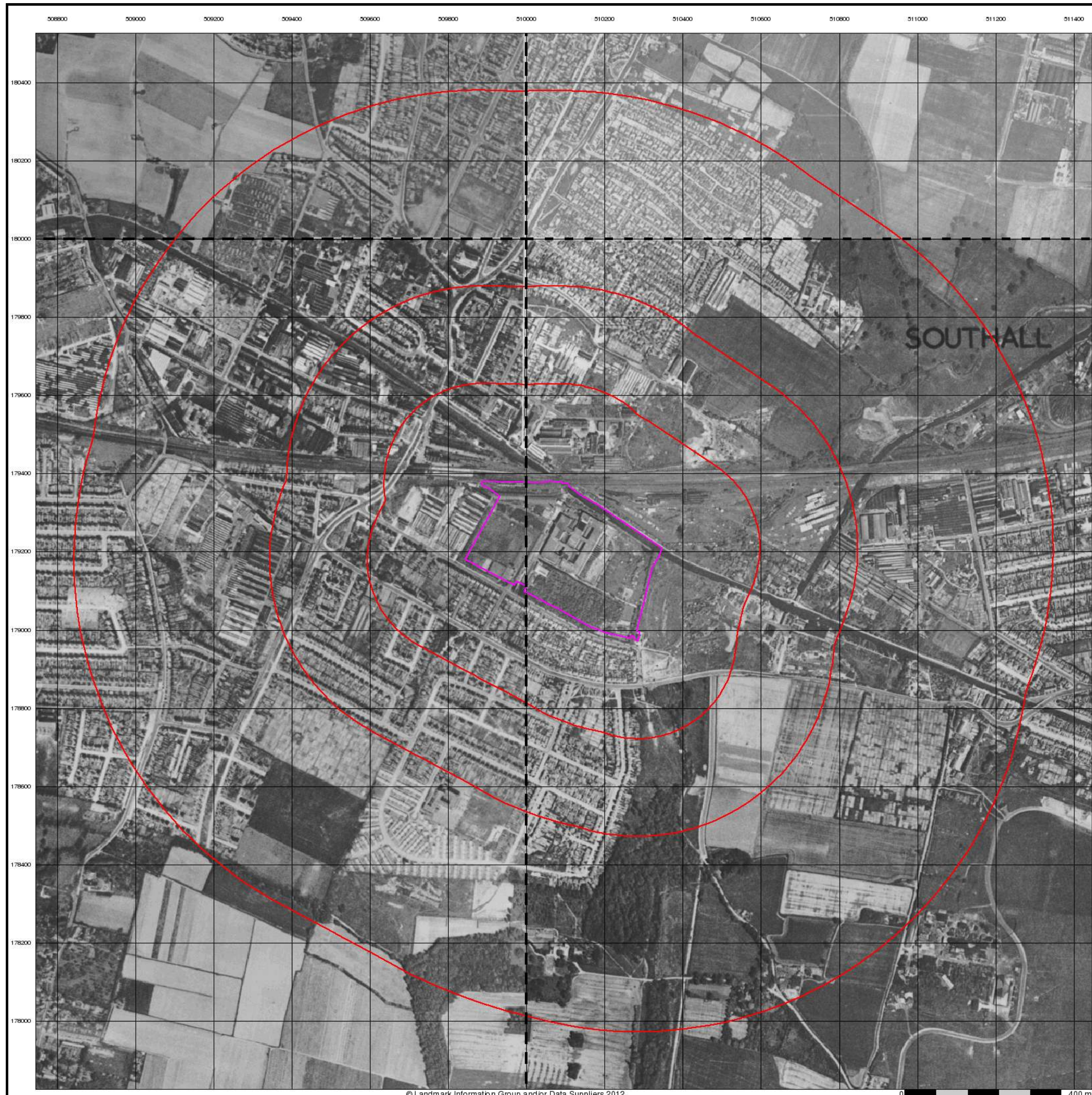


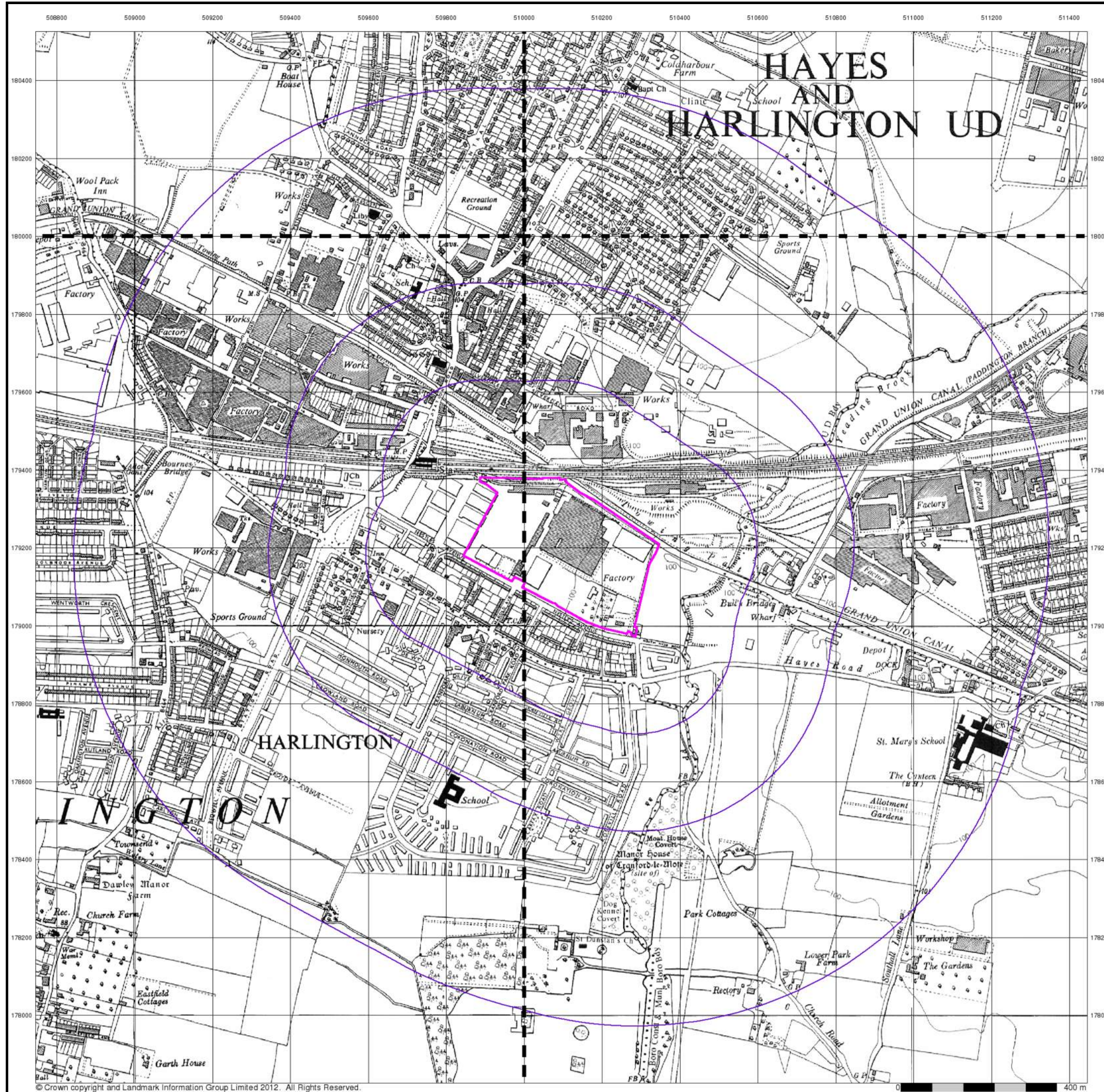
### Order Details

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details

Nestle UK Ltd, Beverage Division, North Hyde Gardens, HAYES, Middlesex, UB3 4RF





### Ordnance Survey Plan

Published 1960

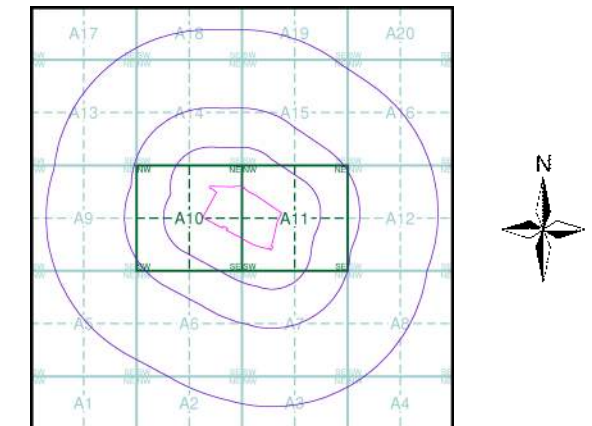
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

### Map Name(s) and Date(s)

TQ08SE	TQ18SW
1960	1960
1:10,560	1:10,560
TQ07NE	TQ17NW
1960	1960
1:10,560	1:10,560

### Historical Map - Slice A

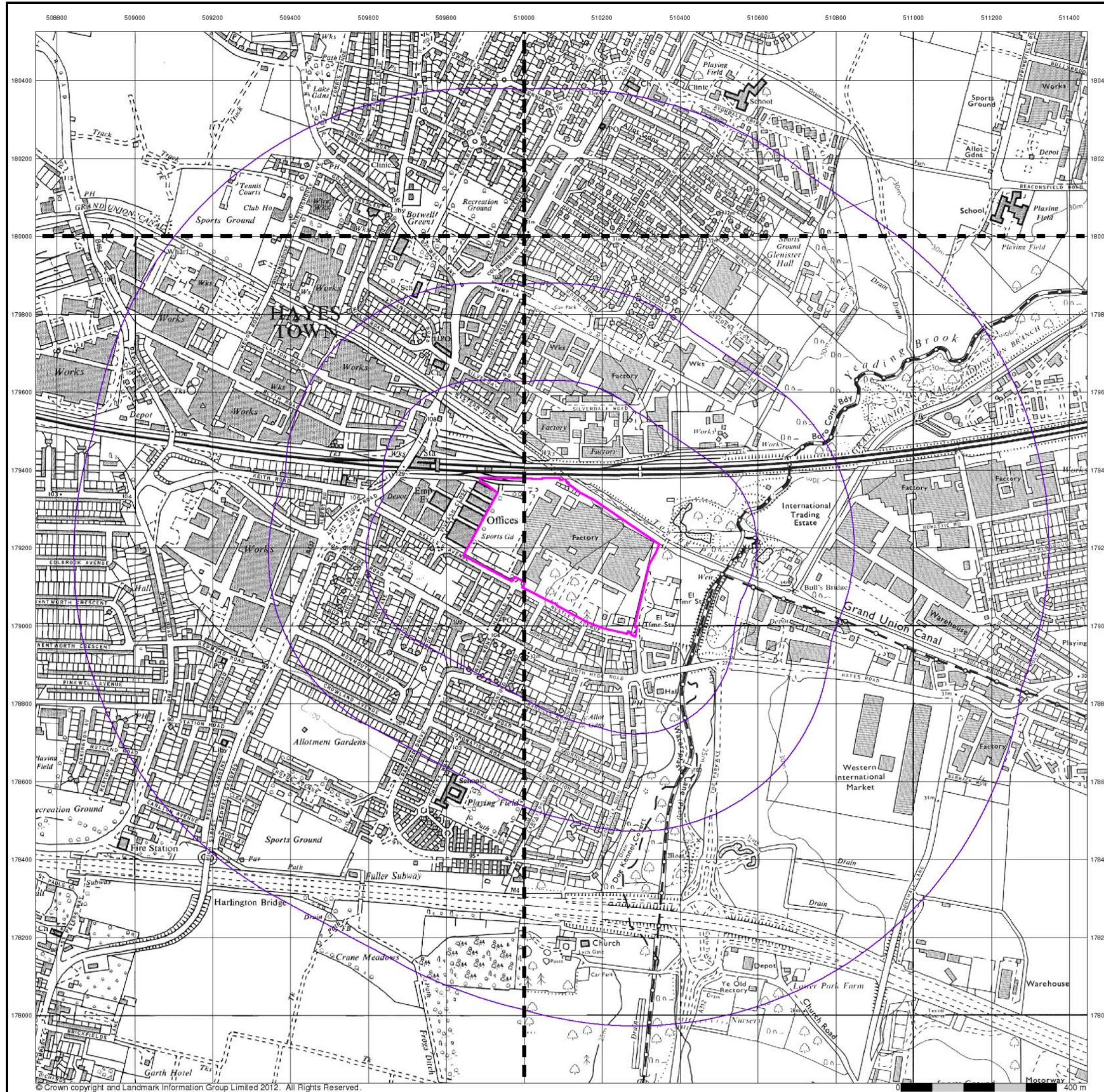


### Order Details

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details

Nestle UK Ltd, Beverage Division, North Hyde Gardens, HAYES, Middlesex, UB3 4RF



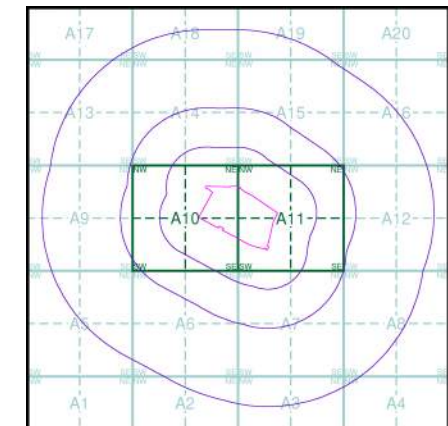
## Ordnance Survey Plan Published 1970 - 1975 Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

### Map Name(s) and Date(s)

TQ08SE	TQ18SW
1970	1975
1:10,560	1:10,000
TQ07NE	TQ17NW
1970	1974
1:10,560	1:10,000

### Historical Map - Slice A

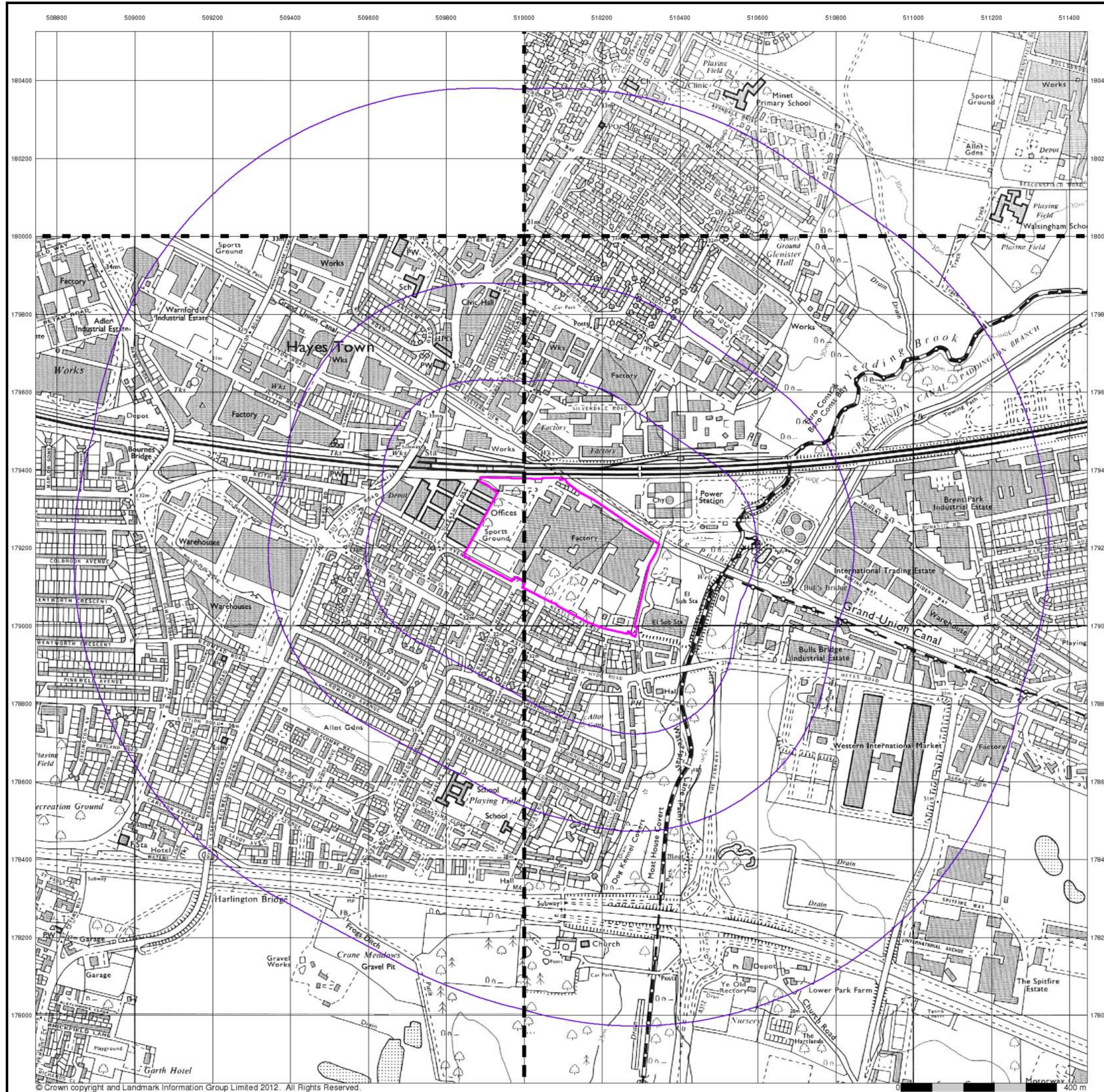


### Order Details

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF



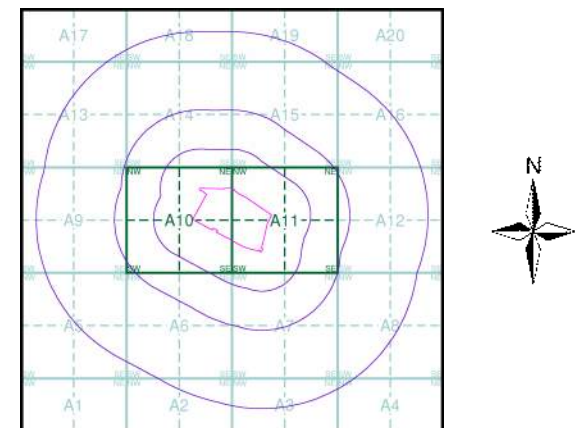
**Ordnance Survey Plan**  
**Published 1985 - 1989**  
**Source map scale - 1:10,000**

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

**Map Name(s) and Date(s)**

TQ18SW	1985	1:10,000
TQ07NE	1989	1:10,000
TQ17NW	1985	1:10,000

**Historical Map - Slice A**

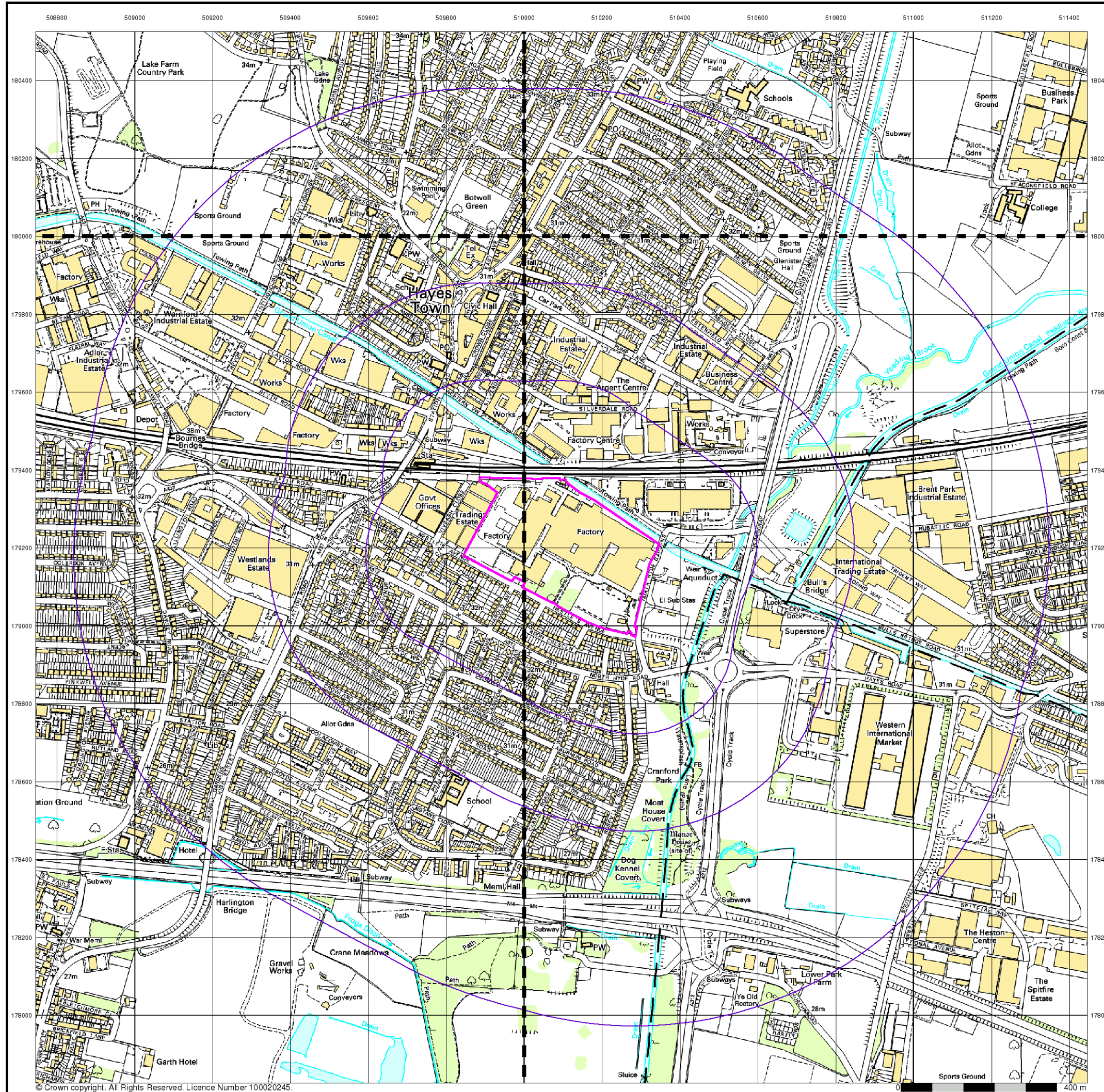


**Order Details**

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

**Site Details**

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF



## 10k Raster Mapping

### Published 2006

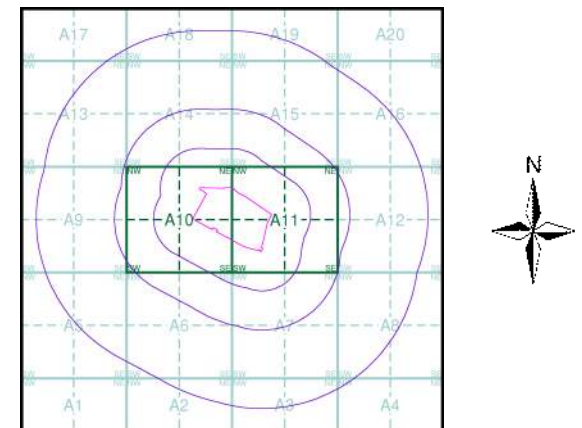
### Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

### Map Name(s) and Date(s)

TQ08SE	TQ18SW
2006	2006
1:10,000	1:10,000
TQ07NE	TQ17NW
2006	2006
1:10,000	1:10,000

### Historical Map - Slice A



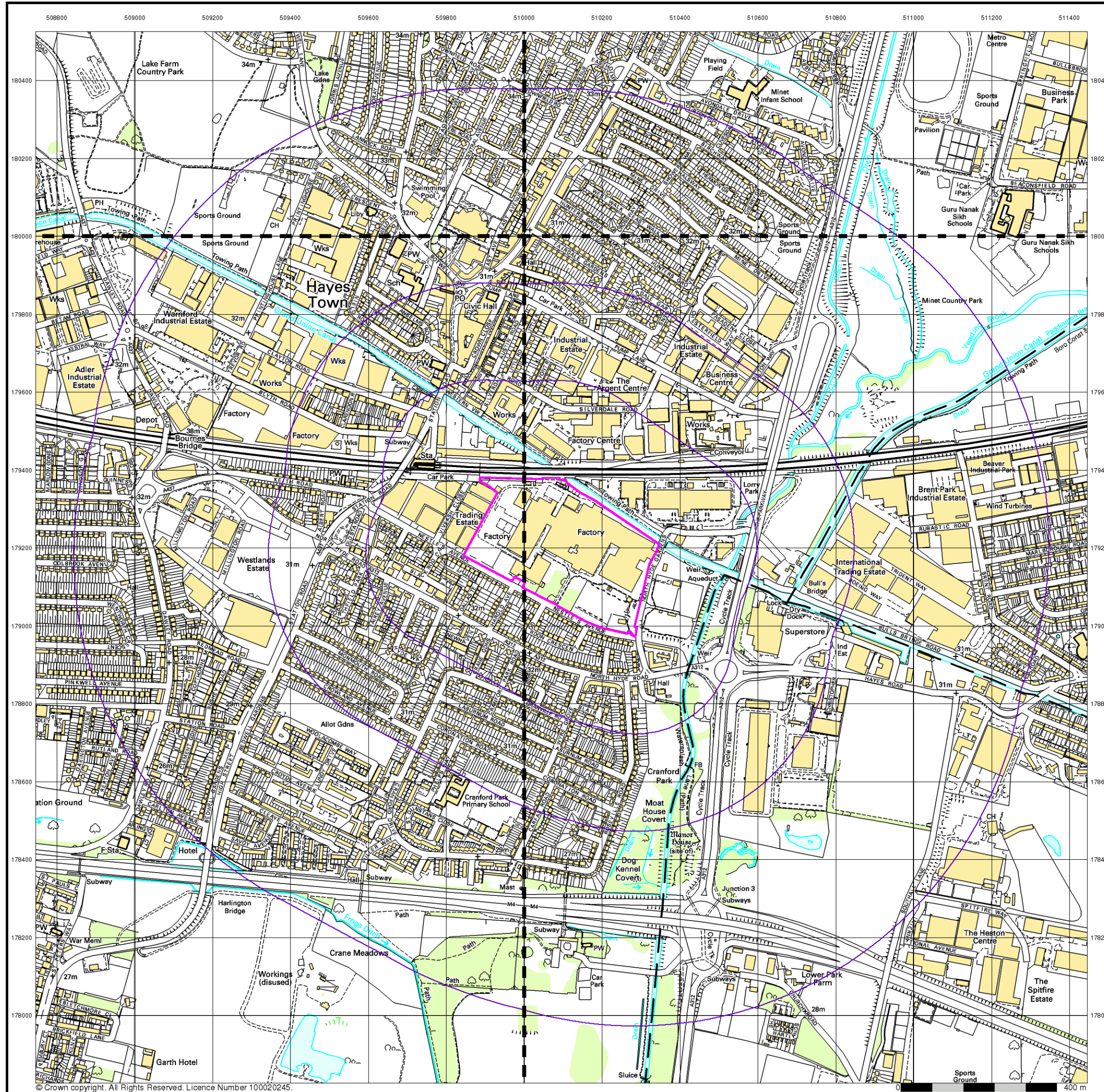
### Order Details

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

### Site Details

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF





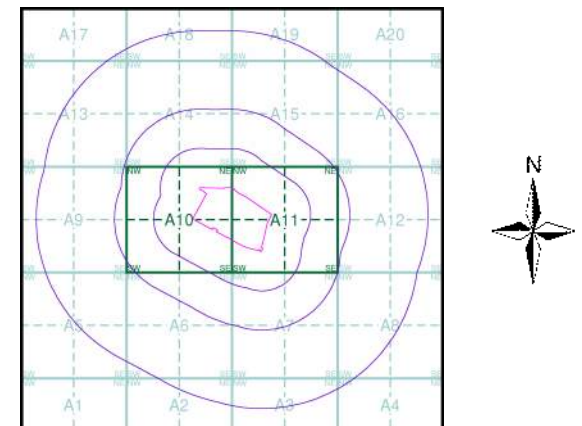
**10k Raster Mapping**  
**Published 2013**  
**Source map scale - 1:10,000**

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

**Map Name(s) and Date(s)**

TQ08SE	TQ18SW
2013	2013
1:10,000	1:10,000
TQ07NE	TQ17NW
2013	2013
1:10,000	1:10,000

**Historical Map - Slice A**



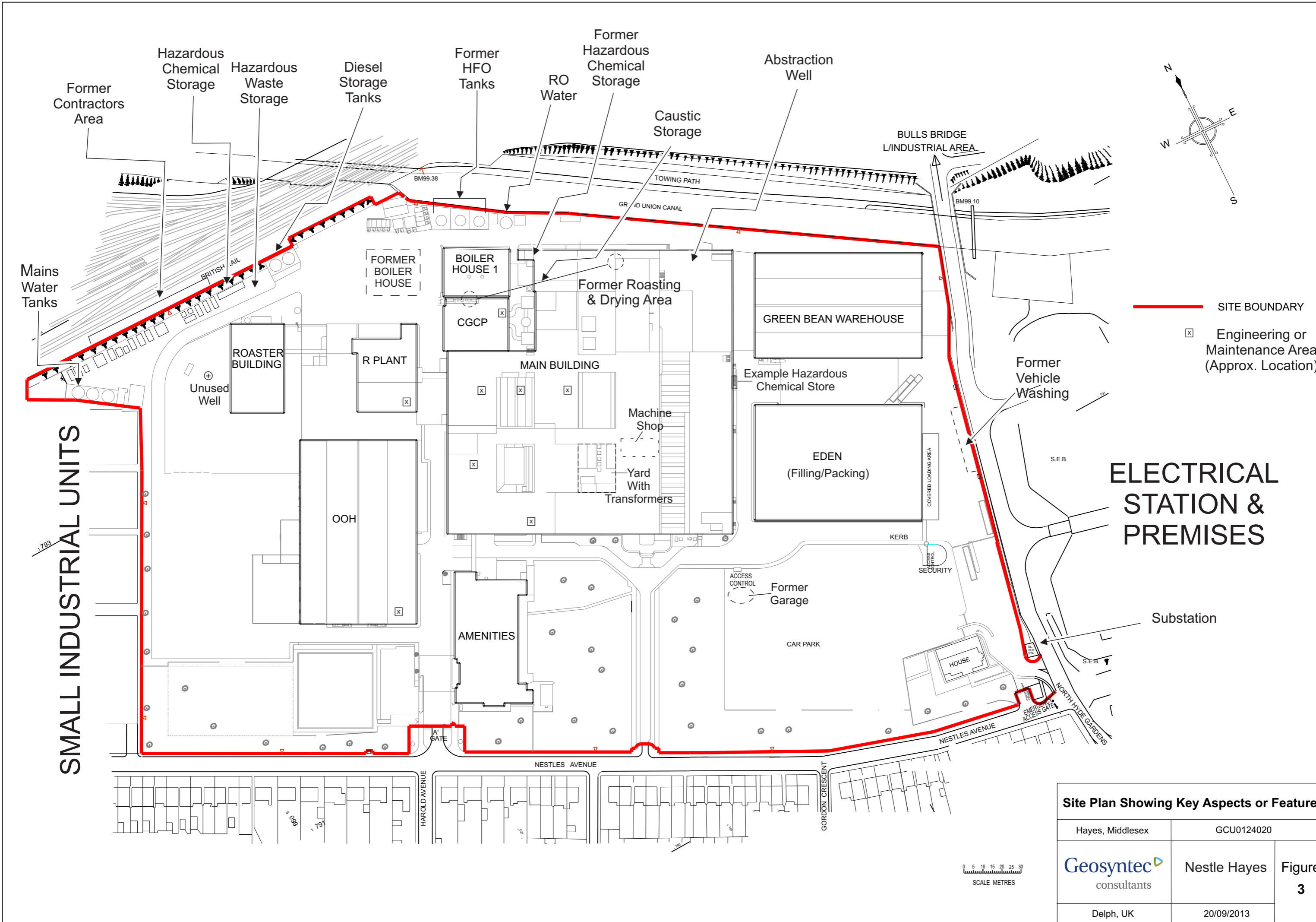
**Order Details**

Order Number: 48644303\_1\_1  
 Customer Ref: GCU0124020  
 National Grid Reference: 510100, 179190  
 Slice: A  
 Site Area (Ha): 12.29  
 Search Buffer (m): 1000

**Site Details**

Nestle UK Ltd, Beverage Division, North Hyde Gardens,  
 HAYES, Middlesex, UB3 4RF

## Appendix H – Previous Report Extracts



# ELECTRICAL STATION & PREMISES

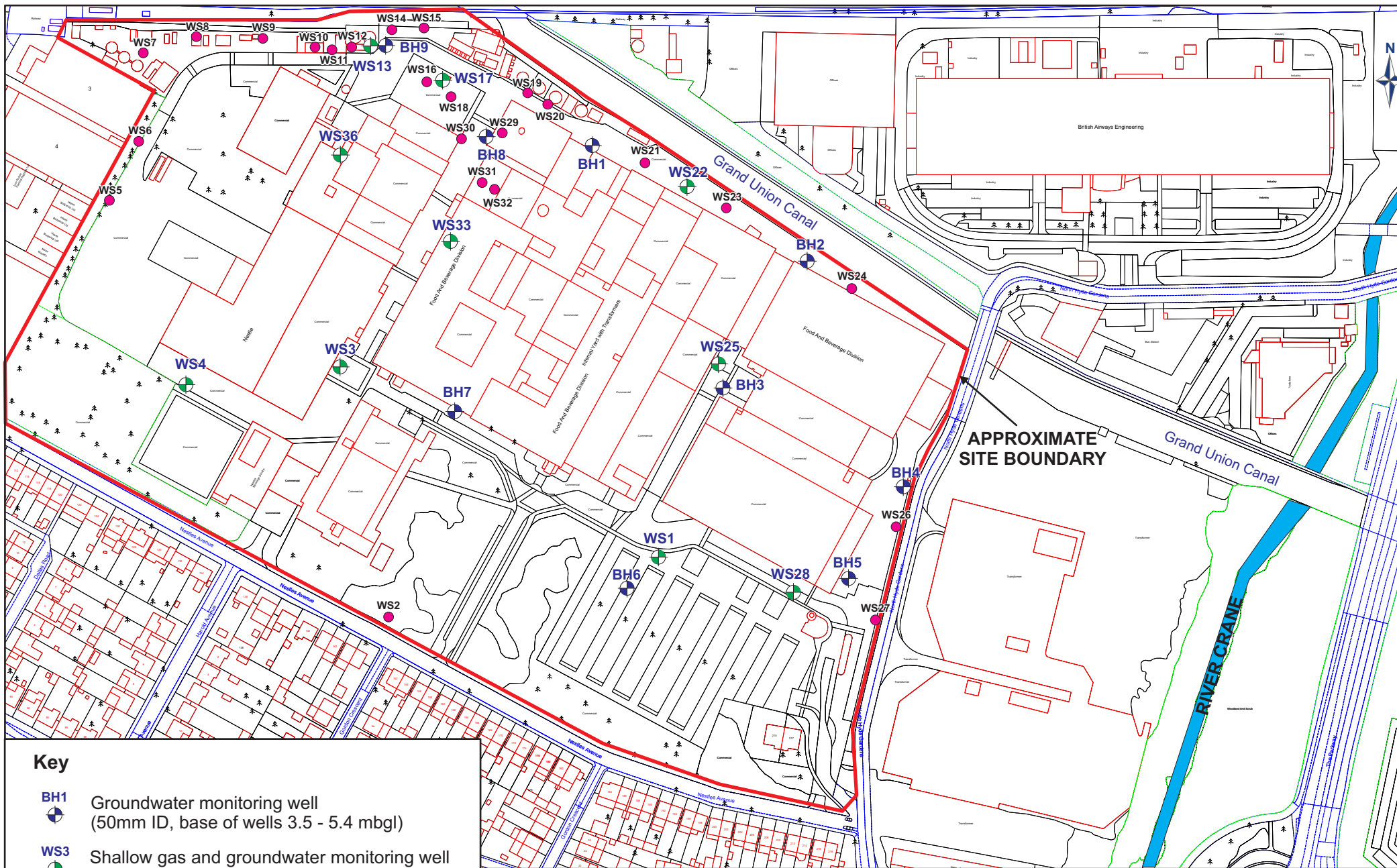
- SITE BOUNDARY
- x Engineering or Maintenance Area (Approx. Location)

**Site Plan Showing Key Aspects or Features**




Hayes, Middlesex		GCU0124020	
	Nestle Hayes	Figure 3	
	Delph, UK	20/09/2013	

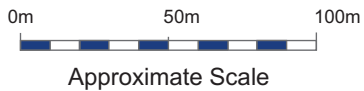
SMALL INDUSTRIAL UNITS

0 5 10 15 20 25 30  
SCALE METRES



**Key**

- BS1**  Groundwater monitoring well (50mm ID, base of wells 3.5 - 5.4 mbgl)
- WS3**  Shallow gas and groundwater monitoring well (25mm ID, base of wells ≤2.0 mbgl )
- WS2**  Shallow soil sampling location (≤2.0 mbgl )



**Geosyntec**  
consultants

Nestlé UK  
Ltd

Figure  
**3**

**Site Plan Showing all Phase 2  
Investigation Locations**

Delph, UK

June 2014

Nestlé UK Ltd, Hayes

GCU0124024  
**Print in colour**



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 29/11/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 30.47 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH1**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.60		MADE GROUND: Old concrete. Friable, cannot use core barrel. Breaker used to remove layer.				
0.80		Soft grey/black sandy gravelly CLAY. Possibly reworked in upper section.	Black staining with oil type hydrocarbon odour, 0.8 - 1.0m.			
1.90					1.7 ppm	
2.10		Soft grey/brown SILT. Grading to black peat in places with some fibrous rootlets/ plant material.	Moist.		6.8 ppm	
2.40		Soft grey/brown gravelly SILT. Gravel is medium to coarse of flint.	Moist.			
		Grey gravelly coarse SAND. Gravel is fine of flint.	Wet.		9.1 ppm	
					7.7 ppm	
		From 2.5m - grading to sandy GRAVEL of fine to coarse, angular to sub rounded flint.			4.1 ppm	
					2.0 ppm	
		Poor recovery from 2.8 - 4.0m. Inferred gravelly SAND.			9.0 ppm	
4.00		Firm to stiff brown CLAY	Dry.			
		Becoming grey from 4.5m.				
		End of boring: 5.1 mbgl.				
5.10						
6						

Notes: Hand dug to 1.2 mbgl. Sand and gravel collapse on extraction of augers, 4.0 - 2.2 mbgl. Geosock fitted.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 02/12/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 30.50 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH2**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.60		MADE GROUND: Old concrete. Friable, cannot use core barrel. Breaker used to remove layer.				
0.80		Brown clayey GRAVEL of medium to coarse flint. Possibly reworked in upper section.	Wet.			
1.30		Soft gravelly SILT. Grading to black peat in places with some fibrous rootlets/plant material. 1 large cobble of flint.	Moist to wet.		1.8 ppm	
1.50		No recovery. Inferred SAND & GRAVEL.	Wet.		3.4 ppm	
2					5.4 ppm	
2.40		Brown SAND & GRAVEL. Sand is coarse. Gravel is fine to medium, occasionally coarse of angular to sub rounded flint.	Wet.		3.6 ppm	
3.00		Some clean gravel horizons. ~10 - 20 cm thick.	Wet.		5.4 ppm	
3.70		Brown gravelly coarse SAND. Gravel is fine to medium, occasionally coarse of angular to sub rounded flint.	Wet.		5.5 ppm	
4.00		Stiff brown CLAY.	Dry.			
4.80		End of boring: 4.8 mbgl.				

Notes: Hand dug to 1.2 mbgl. Sand and gravel collapse on extraction of augers, 4.0 - 2.0 mbgl. Geosock fitted.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 28/11/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 30.06 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH3**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.35		Soft brown slightly gravelly CLAY with occasional rootlets. Gravel is fine rarely medium to coarse of flint.  Possibly reworked in upper sections.			4.1 ppm	
1.30		Dark grey clayey GRAVEL. Gravel is medium to coarse, angular to sub rounded of flint.	Wet.		3.8 ppm	
1.50		Gravelly coarse SAND becoming sandy GRAVEL from 1.6m. Gravel is medium to coarse, angular to sub rounded of flint.	Wet.		2.8 ppm	
2		Band of coarse brown SAND from 2.6 - 2.8m.			5.0 ppm	
3.40		Stiff brown CLAY.			5.2 ppm	
3.90		End of boring: 3.9 mbgl.	Dry.		5.9 ppm	
4					4.2 ppm	
6						

Notes: Hand dug to 1.2 mbgl. Geosock fitted.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 29.47 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH4**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.33		MADE GROUND: slightly clayey sandy gravel of fine to coarse brick and stone of mixed lithologies. With occasional pieces of asphalt and slag type material.  At 0.8m: Partial obstruction of hole - sloping concrete surface. Hole off-set and re-cored. Cobbles of / broken concrete below obstruction.				
1.50		Black/ dark grey SILT with occasional rootlets.	Wet			
2.00		Grading to clayey slightly sandy GRAVEL of medium to coarse flint.	Wet		0.5ppm	
2.90		Stiff brown/grey CLAY.  From 3.0 - 3.1m: Coarse SAND.  END: 4.4m: Into London Clay.	Dry		0.7ppm	
4.00					0.5ppm	
4.40					0.3ppm	
					0.3ppm	

Notes: Hand dug to 1.2 mbgl. Window sample to depth. GW monitoring well installed.





Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 28/11/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 29.58 maOD  
 Borehole Diameter:  
 Installation Diameter:  
 Slot Size:  
 Method:

Borehole Reference:  
**BH4a**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with 20mm steel reinforcement bar.				
0.40		MADE GROUND: Coarse beige gravel. (sub-base).	Dry.		1.3 ppm	
0.50		MADE GROUND: Brown medium sand. (sub-base).	Dry.		1.7 ppm	
0.60		MADE GROUND: Dark brown/grey slightly clayey sandy gravel. Gravel is fine to medium occasionally coarse of brick and flint, with rare fragments of wood. Possibly with some ash.	Dry.			
0.90		MADE GROUND: 1 very large cobble/boulder encountered at 0.9 m. Flat surface, possibly large brick or paving slab.	Dry.			
1.00		Obstruction and refusal at 0.9 - 1.0 mbgl.				
2						
4						
6						

Notes: Hand dug to 0.9mbgl. Refusal on large brick/paving slab obstruction. Backfilled with bentonite, cement at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 29/11/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 29.20 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH5**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.30		MADE GROUND: Brown/black slightly silty, gravelly coarse sand. Gravel is of flint with some slag. occasional small cobble sized pieces of red brick and slag.	Dry.		3.2 ppm	
1.00		Soft black/grey slightly gravelly SILT with some rootlets and fragments of wood. Slightly peaty in places. Gravel is fine to coarse of flint.	Moist.		1.2 ppm	
1.60		Soft grey slightly gravelly CLAY. Gravel is fine to coarse of flint.	Dry.		3.8 ppm	
1.80		Quickly grading to clayey GRAVEL of fine to coarse, angular to sub rounded flint.	Dry.		5.0 ppm	
2.40		Becoming sandy clayey GRAVEL towards 2.4m.	Moist.		6.2 ppm	
2.80		Grading to brown slightly clayey gravelly medium to coarse SAND.				
		Brown sandy GRAVEL of fine to coarse angular to sub rounded flint.	Wet.			
		Band of coarse SAND from 3.4 - 3.6m.				
4.00		Firm brown CLAY.	Dry.		8.2 ppm	
4.20		End of boring: 4.2 mbgl.			8.4 ppm	

Notes: Hand dug to 1.2 mbgl. Sand and gravel collapse on extraction of augers, 4.2 - 3.3 mbgl. Geosock fitted.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 26/11/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 30.06 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH6**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Asphalt.			
0.10		MADE GROUND: Coarse gravel. (sub base).	Moist from 0.9m.		
0.15		MADE GROUND: Brown sandy Gravel. Gravel is fine to coarse, angular sub angular of brick, concrete and stone (suspected demolition rubble).			1.9 ppm
1.05		Becoming clayey from 0.7 m. Possible reworked natural deposits from this depth.	Moist from 1.05m.		0.0 ppm
		Brown sandy GRAVEL. Sand is coarse. Gravel is fine to coarse, angular to sub rounded of flint.	Wet from ~1.8m.		0.2 ppm
		Band of gravelly coarse SAND from 1.2 - ~1.8 m.			0.2 ppm
2					0.2 ppm
					0.1 ppm
4		Firm dark brown CLAY.	Dry.		0.9 ppm
		Becoming grey dark grey from 4.4m.			3.9 ppm
		End of boring: 5.2 mbgl.			2.7 ppm
5.20					3.5 ppm
6					

Notes: Hand dug to 1.2 mbgl. No Geosock fitted.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 26/11/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 31.06 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH7**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.15		MADE GROUND: Brown sandy gravel of flint. Possibly reworked.  Becoming clayey sandy gravel from 0.9m.			
1.00		Soft brown gravelly clay. Possibly reworked	Moist from 1.3m.		
1.40		Becoming slightly gravelly from 1.3m.			2.9 ppm
1.90		Brown slightly clayey slightly sandy GRAVEL. Gravel is coarse, angular to sub rounded of flint.	Faint black staining from 1.5 - 1.9m. Wet from 1.8m.		5.5 ppm
2		Becoming grey, slightly clayey medium to coarse GRAVEL of flint from 1.8m.	Wet.		6.7 ppm
		Brown sandy gravel of medium to coarse, angular to sub rounded flint.			6.6 ppm
		Band of coarse SAND from 3.65 - 3.85m.			6.2 ppm
					7.8 ppm
					8.1 ppm
4					7.9 ppm
					8.4 ppm
					5.8 ppm
6		Stiff brown CLAY.	Dry.		7.9 ppm
6.35		End of boring: 6.35 mbgl.			5.0 ppm

Notes: Hand dug to 1.2 mbgl. Sand and gravel collapse on extraction of augers, 6.0 - 5.4 mbgl. Well pipe placed and further collapse from 5.4 - 4.5 mbgl. No Geosock fitted.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 27/11/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 31.06 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH8**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.50		MADE GROUND: Full and half bricks.			
0.60		Brown clayey GRAVEL of medium to coarse sub angular flint. Possibly reworked in upper section.	Moist. Faint black staining from 1.5 - 2.0m (possibly natural dark grey colouration).		
2		Brown sandy GRAVEL of fine to coarse angular to sub rounded flint.	Wet.		
2.50					4.7 ppm
					6.0 ppm
					2.5 ppm
					7.9 ppm
					7.4 ppm
					7.7 ppm
					7.0 ppm
					5.7 ppm
4					
4.60		Firm brown CLAY.	Dry.		8.2 ppm
		Becoming grey from 5.0m.			6.3 ppm
		End of boring: 5.4 mbgl.			
5.40					
6					

Notes: Hand dug to 1.2 mbgl. No Geosock fitted.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 27/11/2013  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 31.15 maOD  
 Borehole Diameter: 200mm  
 Installation Diameter: 50mm ID  
 Slot Size: 1-2mm  
 Method: HSA / WS

Borehole Reference:

**BH9**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.20		MADE GROUND: Dark grey/black silty gravel of brick, slag and clinker.  Becoming clayey gravel from ~0.8m. With some large cobble sized pieces of slag and 1 boulder of slag at 1.2m.	Dry to 0.8mbgl. Standing water in base of pit after 14 hours with iridescent hydrocarbon sheen and odour. Not observed below 1.45 mbgl.		5.5 ppm
1.50		Brown sandy GRAVEL of fine to coarse angular to sub rounded flint. Sand is coarse.	Moist.		+50 ppm / 7.8 ppm
1.80		No recovery. Inferred SAND & GRAVEL.	Wet.		7.7 ppm
2.50		Brown sandy GRAVEL of fine to coarse angular to sub rounded flint. Sand is coarse.	Wet.		5.9 ppm
3.80		Poor recovery. Inferred gravelly coarse SAND.	Wet.		5.8 ppm
5.20		Firm to stiff brown CLAY.	Dry.		7.7 ppm
5.30		End of boring: 5.3 mbgl.			

Notes: Hand dug to 1.2 mbgl. Geosock fitted.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 20/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 30.16 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS1**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.23		MADE GROUND: Grey/brown slightly clayey sandy coarse gravel of brick and concrete.			10.0 ppm	
0.65		Black slightly sandy slightly gravelly SILT. Gravel is fine to medium of flint.			9.5 ppm	
0.85		Becoming gravelly SILT from 0.7m.			9.3 ppm	
		Black/brown slightly clayey slightly sandy GRAVEL of sub-rounded to angular, fine to coarse flint.			9.3 ppm	
		Becoming clayey from 1.1m			15.1 ppm	
1.20		Brown sandy GRAVEL of angular to subangular, fine to coarse flint.	Wet, NDO.		43 ppm	
		END: 2.0m - Refusal on coarse flint.			53 ppm	
					57 ppm	
2						

Notes: Hand dug to 1.2 mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 19/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS2**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Grass over soft brown clayey sand with rootlets. (TOPSOIL).				
0.45		MADE GROUND: Soft brown slightly sandy clay with occasional fine - coarse gravel of mixed lithologies.  Large brick pieces (up to half brick) from 0.9m.			0.2ppm	
1.05		MADE GROUND: Brown clayey gravel of sub-angular to sub-rounded fine to coarse brick and stone of mixed lithologies.			0.2ppm	
1.20		Brown/beige sandy GRAVEL of angular to subangular fine to medium, occasionally coarse flint.  END 1.6m: Refusal on flint gravel.	Dry, NDO.		50ppm	
1.60					24.4ppm	
2						

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.





Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 19/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 31.20 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS3**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: concrete with steel reinforcement bar.				
0.26		MADE GROUND: Soft brown clayey sandy gravel of fine to medium brick and stone of mixed lithologies.			18.2ppm	
					18.6ppm	
					27.2ppm	
0.90		Firm brown slightly gravelly CLAY. Gravel is of fine sub-angular flint.			25.1ppm	
		From 1.0m grading to clayey GRAVEL of fine to coarse of sub-angular flint.			21.0ppm	
1.20		Brown slightly clayey gravelly medium SAND. Gravel is of fine to medium sub-angular flint.	Wet		51ppm	
1.50		Sandy GRAVEL of fine to coarse angular flint.	Moist		55ppm	
1.90		Brown slightly gravelly medium SAND. Gravel is of fine to medium sub-angular flint.	Wet		40ppm	
2.00		END: 2.0m - refusal on flint gravel.			51ppm	

Notes: Hand dug to 1.2 mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 19/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 31.19 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS4**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.20		MADE GROUND: Slightly clayey slightly sandy gravel of fine to medium, occasionally coarse brick and stone of mixed lithologies.			18.9ppm	
0.45		MADE GROUND: Soft brown slightly sandy gravelly clay. Gravel is fine to coarse of brick and flint.  From 0.85m becoming firm to stiff.			18.2ppm	
					36.1ppm	
					25.6ppm	
1.20		Brown sandy gravelly CLAY. Gravel of fine to coarse flint.	Moist, NDO		46ppm	
1.30		Slightly clayey gravelly medium to coarse SAND. Gravel is of fine to coarse sub-angular flint.	Moist, NDO		69ppm	
1.60		Brown slightly gravelly SAND. Gravel is of fine to coarse sub-angular flint.  END: 2.0m - refusal on coarse flint gravel.	Moist, NDO		75ppm	
					48ppm	
2.00						

Notes: Hand dug to 1.2 mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS5**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Dark brown clayey gravelly sand with rootlets (TOPSOIL).  From 0.5m becoming with gravel of brick.  From 0.85m becoming clayey sand with rare gravel of brick.			
0.90		Brown sandy gravelly CLAY. Gravel is of fine to coarse, angular to subangular flint with rare cobbles of flint.			0.0 ppm
1.20		Brown/red gravelly medium to coarse SAND. Gravel is of fine to coarse, angular to sub-angular flint.  END: 2.0m - refusal on coarse flint gravel.	Dry, NDO.		0.4 ppm
2.00					0.4 ppm

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS6**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Dark brown slightly clayey gravelly sand with rootlets. Gravel is fine to medium of ceramics and brick.  From 0.9m becoming clayey.			
					0.0ppm
					0.0ppm
					0.0ppm
1.10		MADE GROUND: Sandy gravelly clay. Gravel is medium of brick and flint.			0.0ppm
1.20		Becoming gravelly clay with depth.			
1.30		Dark brown slightly clayey GRAVEL of flint with some rootlets.	Dry, NDO.		
		Red/brown slightly silty slightly gravelly medium SAND. Gravel is of fine to medium flint, occasionally coarse from 1.5m.			0.2ppm
		END: 1.8m - refusal on coarse flint gravel.			
1.80					
2					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 13/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS7**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Asphalt.			
0.06		MADE GROUND: Broken concrete (cobbles) with brown sand.			
0.30		Grey/brown silty gravelly sand. Gravel is fine to coarse with occasional cobbles of brick, concrete and slag type material.			0.0ppm
0.70		Brown mottled slightly sandy clay. Sand is fine.	Dry.		0.1 ppm
1.00		END: 1.0 m - refusal on flat surface. Possible covered void (duct).			
2					

Notes: Hand dug to 1.0 mbgl. Backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS8**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.10		MADE GROUND: Grey silty gravelly sand. Gravel is fine to medium, sub-angular to sub-rounded of brick and stone (mostly flint).  10cm band of soft grey sandy clay from 0.2 - 0.3m.  Becoming clayey slightly gravelly sand with depth.			0.2ppm
					0.1ppm
0.80		Firm orange/brown sandy CLAY.  From 1.1m becoming slightly gravelly. Gravel is of medium to coarse angular to sub-angular flint.			0.1ppm
					0.1ppm
1.20		Brown/orange gravelly medium to coarse SAND. Gravel is fine to coarse of angular to subangular flint.  END: 2.3m - refusal on coarse flint gravel.	Dry, NDO.		0.1ppm
					0.1ppm
2					0.1ppm
					0.3ppm
2.30					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS9**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.06		MADE GROUND: inferred demolition rubble.			
0.30		Brown clayey gravelly medium SAND. Gravel fine to medium of flint.  From 0.9m becoming slightly gravelly.			0.0ppm
					0.0ppm
					0.0ppm
1.10		Clayey sandy GRAVEL of fine to coarse, angular to sub-rounded flint.			0.0ppm
1.20		Red/brown gravelly medium to coarse SAND. Gravel is coarse of angular to subangular flint.  END: 1.8m - refusal on coarse flint gravel.	Moist, NDO.		0.3ppm
1.80					
2					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS10**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.26		MADE GROUND: Brown clayey gravelly fine sand. Gravel is fine to coarse of concrete with fragments of glass and ceramics.  Boulder of slag type material at 0.9m.			0.1ppm
					0.1ppm
0.95		Clayey sandy GRAVEL of medium to coarse flint.			0.0ppm
					0.0ppm
1.20		Brown/red slightly gravelly medium SAND. Gravel is medium to coarse of flint.  END: 0.7m - refusal on coarse flint gravel.	Moist, NDO.		0.3ppm
1.70					
2					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.





Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 13/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS11**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.22		MADE GROUND: Dark grey/brown silty sandy gravel of fine to coarse with occasional cobbles of concrete, stone, brick and slag type material.	Dry.		0.1ppm	
0.66		END 0.66m - buried services encountered.			0.3ppm	
2						

Notes: Hand dug to 0.66 mbgl. Backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 20/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS12**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.33		MADE GROUND: Coarse gravel (sub-base).			
0.60		MADE GROUND: Dark brown clayey sandy gravel of fine to coarse brick and stone of mixed lithologies.  Becoming gravelly clay with depth.	Wet.		22.0 ppm
0.90		Firm becoming stiff brown slightly gravelly CLAY. Gravel is fine to medium of flint.			19.3 ppm
1.22		Firm becoming stiff brown slightly gravelly CLAY. Gravel is fine to medium of flint.			16.3 ppm
1.22		Brown grey sandy GRAVEL of fine to coarse angular to subangular flint.  From 1.50 - 1.65m: red/brown medium SAND. Becoming clayey SAND.  END: 2.0m - refusal on coarse flint gravel.	Moist to wet. NDO.		25 ppm
2.00					41 ppm
2					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 31.14 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS13**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.39		MADE GROUND: Brown clayey sandy gravel of fine to medium (occasionally coarse with rare cobbles), sub-angular to sub-rounded brick and stone of mixed lithologies.			0.0ppm	
0.65		MADE GROUND: Brown gravelly clay. Gravel is of fine to medium, subangular to sub-rounded brick and stone of mixed lithologies.	Wet at 1.1			
1.20		Brown gravelly medium to coarse SAND. Gravel is of fine to coarse, angular to sub-angular flint.  END: 1.9m - refusal on coarse flint gravel.	Wet becoming moist, NDO.		0.0ppm	
1.90					0.5ppm	
1.90					0.4ppm	
2						

Notes: Hand dug to 1.2 mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS14**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.27		MADE GROUND: Grey/brown clayey sandy gravel. Gravel is fine to coarse, rounded to subangular of mixed lithologies.  END: 0.9m - refusal on hard surface - inferred concrete obstruction.	Dry.		0.1ppm	
0.90					0.1ppm	
2						

Notes: Hand dug to 0.9 mbgl. Backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS15**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.24		MADE GROUND: Grey/brown slightly clayey sandy gravel. Gravel is fine to coarse, angular to rounded of mixed lithologies.			0.0ppm
0.45		Becoming clayey with depth. Firm to stiff brown very slightly sandy slightly gravelly CLAY. Gravel is of fine to coarse, angular to sub-angular flint.			0.0ppm
					0.0ppm
					0.2ppm
1.40		Grey/brown clayey gravelly medium SAND. Gravel of fine to coarse flint. END: 2.0m - refusal on coarse flint gravel.	Moist, NDO.		0.4ppm
2.00					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS16**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.45		MADE GROUND: Slightly sandy coarse gravel of brick and concrete with occasional cobbles of concrete and half bricks.  Becoming clay with brick fragment at base.	Water at 0.72mbgl, with oily sheen.		
1.20		Brown/beige slightly sandy gravelly CLAY. Gravel is fine to medium of flint.  Becoming more sandy with depth.	Moist, NDO		0.2ppm 0.3ppm 0.2ppm
1.75 1.80		Slightly clayey sandy GRAVEL of coarse, angular flint.  END: 1.8m - refusal on coarse flint gravel.	Moist, NDO		0.2ppm
2					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 31.18 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS17**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.22		MADE GROUND: Grey/brown slightly sandy clayey gravel of fine to coarse subangular to sub-rounded brick and stone of mixed lithologies.			0.3ppm	
					0.2ppm	
					0.3ppm	
1.10		Firm grey gravelly clay. Gravel is fine to coarse of brick and stone of mixed lithologies.				
1.20		Silty coarse gravel of brick and stone of mixed lithologies.				
1.30		Firm beige/brown slightly gravelly sandy CLAY. Gravel is of fine angular to sub-angular flint.	Moist, NDO.		14.8ppm	
1.50		Firm sandy CLAY with discrete ~5-10cm bands of fine to medium sand.	Slight black staining apparent in some of the sand (not throughout), NDO.			
		END: 2.0m - refusal on stiff clay.			0.3ppm	
2.00						

Notes: Hand dug to 1.2 mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS18**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.38		MADE GROUND: Grey slightly sandy slightly clayey gravel.	Dense black residual tar like coating on some gravel surfaces.		0.5ppm	
0.65		END: 0.65m - sloping concrete obstruction.			1.1ppm	
2						

Notes: Hand dug to 0.65 mbgl. Backfilled with arisings, concrete at surface.





Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS19**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.17		MADE GROUND: Grey/brown slightly clayey sandy gravel of fine to coarse brick and tarmac, mostly coarse with depth.  From 0.7m becoming clayey/with pockets of clay.  END: 1.05m - refusal on submerged hard surface - inferred concrete obstruction.	Wet from 0.6m.		0.0ppm	
					0.0ppm	
					0.0ppm	
1.05						
2						

Notes: Hand dug to 1.05 mbgl. Backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 17/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:  
**WS20**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.08		MADE GROUND: Brown/grey sandy gravel of concrete and brick with occasional fragments of wood and glass.  END: 0.95m - refusal on concrete obstruction.	Wet from 0.6m. Iridescent sheen to water in pit. Strong hydrocarbon odour and black tar like staining from 0.9m.		
					0.1ppm
					0.1ppm
					0.3ppm
					6.0ppm
0.95					
2					

Notes: Hand dug to 0.95 mbgl. Backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS21**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.45		MADE GROUND: Dark grey slightly clayey sandy gravel of concrete and slag type material.	Strong unpleasant organic odour. Moist becoming wet from ~0.6m.		0.6ppm
0.85		MADE GROUND: Soft gravelly clay. Gravel is fine to medium, subangular of concrete and slag type material.	Less odour.		0.3ppm
1.20		Soft grey/brown CLAY.	Faint black staining and hydrocarbon odour at base of pit.		0.3ppm
1.70		Decomposing wood layer (5cm) over slightly clayey sandy GRAVEL of fine to medium, angular to subangular flint.			63ppm
1.80		END: 1.8m - refusal on coarse flint gravel.			
2					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 30.34 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS22**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.43		MADE GROUND: Grey sandy gravel. Becoming clayey from 0.8m.	Water at ~0.65, no odour.			
0.90		Soft brown/grey slightly gravelly CLAY. Gravel is fine to medium, angular to sub-angular of flint.			0.1ppm	
1.25		Soft grey CLAY. From 1.4m becoming firm, grey/brown mottled CLAY. END: 2.0m - refusal on stiff clay.			0.0ppm	
2.00					0.0ppm	
					0.0ppm	
					36ppm	
					43ppm	
2						

Notes: Hand dug to 1.2 mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS23**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.17		MADE GROUND: Brown slightly clayey sandy gravel. Gravel is fine to medium, (mostly fine with depth) of mixed lithologies.  Concrete slab at 0.55 - 0.6m.  With slag type material from 0.6m.	Wet from ~0.5m, with slight sheen and slight hydrocarbon odour.		10.2ppm	
0.65		END: 0.65m - refusal on inferred concrete obstruction (submerged).			0.4ppm	
2						

Notes: Hand dug to 0.65 mbgl. Backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS24**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.11		MADE GROUND: Slightly clayey sandy gravel of brick, concrete and stone of mixed lithologies.  From 0.6m - with asphalt pieces and small pockets of firm dark brown clay.	From 0.25 - 0.6m - very slight hydrocarbon odour.		0.3ppm
					0.2ppm
					0.2ppm
1.00		Firm dark brown CLAY with large cobble/boulder of concrete.			
1.20		Very soft brown CLAY.	Wet		46ppm
1.50		Clayey GRAVEL of coarse angular to sub-angular flint.  END: 1.9m - refusal on coarse flint gravel.	NDO, moist.		48ppm
1.90					
2					

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 30.40 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS25**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.16		MADE GROUND: Broken concrete.				
0.30		MADE GROUND: Gravelly clay. Gravel is fine to coarse of flint and concrete.			0.2ppm	
0.45		Firm brown slightly gravelly CLAY. Gravel is of fine to medium, angular to sub-angular flint.	NDO. Wet from 1.2m.			
		Grey mottle from 0.65m.			0.2ppm	
		From 1.2m: Becoming soft brown CLAY with occasional coarse flint gravel.			0.2ppm	
1.80		Clayey GRAVEL of medium to coarse, sub-rounded black flint.	NDO, wet.		51ppm	
2.00		END: 2.0m - refusal on coarse flint gravel.			19ppm	

Notes: Hand dug to 1.2 mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS26**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.25		MADE GROUND: Weak/broken concrete. END: 0.65m - refusal on hard concrete obstruction.	NDO.		0.4ppm	
0.65					0.2ppm	
2						

Notes: Hand dug to 0.65 mbgl. Backfilled with arisings, concrete at surface.





Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS27**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.29		MADE GROUND: Weak/broken concrete.			0.2ppm	
0.40		END: 0.75m - refusal on hard concrete obstruction.	Dry.			
		MADE GROUND: Brown/grey sandy gravel of fine to medium concrete.			0.2ppm	
0.70		MADE GROUND: Concrete with steel reinforcement bar.				
0.75		END: 0.75m - refusal on hard concrete obstruction.				

Notes: Hand dug to 0.75 mbgl. Backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 18/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 29.66 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS28**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.29		MADE GROUND: Dark brown slightly clayey sandy gravel. Gravel is fine to coarse, sub-angular to rounded of brick and flint.  From 0.7 - 0.75m - frequent brick fragments.  From 0.75m - becoming clayey with some slag type material.	Reducing odour from 0.6 - 0.7m. Faint sweet hydrocarbon odour from 0.75 - 0.9m.		0.2ppm	
					0.3ppm	
					5.1ppm	
					4.6ppm	
					8.0ppm	
					16.5ppm	
					13.9ppm	
1.15		Soft brown/orange mottle sandy gravelly CLAY. Gravel is of fine angular to sub-angular flint.  From 1.4 - 1.8m - soft grey slightly sandy CLAY.  From 1.8m becoming firm gravelly CLAY. Gravel is coarse of angular to sub-angular flint.  END: 2.0m - refusal on coarse flint gravel.			33ppm	
					43ppm	
					55ppm	
2						

Notes: Hand dug to 1.2 mbgl. End of hole at 2mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 16/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS29**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar. Weak/broken from ~0.35m.			
0.40		MADE GROUND: Light brown silty fine sand.	Dry.		31.3ppm
0.50		MADE GROUND: Concrete with steel reinforcement bar (slabs of).			15.8ppm
		END: 0.9m - refusal on hard concrete.			10.6ppm
0.90					
2					

Notes: Hand dug to 0.9 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 20/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS30**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.31		MADE GROUND: Brown sandy gravel of fine to medium concrete, brick and flint. occasional large fragments of brick.  From 0.9m - becoming clayey sandy gravel (as above) with occasional small pockets of clay.	NDO		15.8ppm 20.2ppm 14.2ppm 30.5ppm 24.6ppm	
1.25		MADE GROUND: Gravelly silty sand. Gravel of concrete.			16.0ppm 59ppm	
1.40		End: 1.4m - refusal on concrete cobble/slab.	Wet. Black stained with slightly tar like residue. No odour.			
2						

Notes: Hand dug to 1.2 mbgl. Reinstated with bentonite to 1.2 mbgl, backfilled with arisings, concrete at surface.



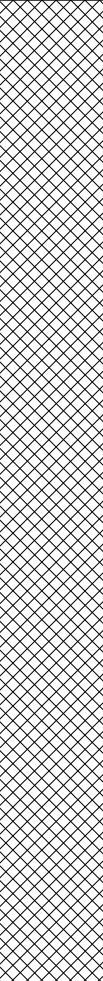
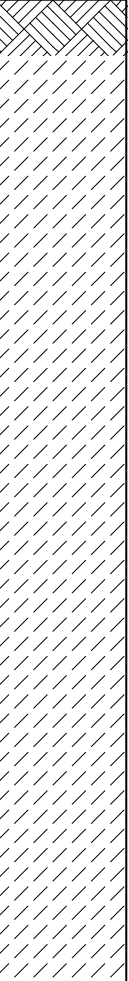
Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 20/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS31**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Multiple layers of concrete with steel reinforcement (some 1/4 inch reinforcement bar).				
1.80						
2						

Notes: Cored to 1.8mbgl. Reinstated with bentonite to ~1.2 mbgl, backfilled with concrete core sections, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 20/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation:  
 Borehole Diameter: 120mm  
 Installation Diameter:  
 Slot Size:  
 Method: Window sample

Borehole Reference:

**WS32**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.40		MADE GROUND: Coarse, angular limestone gravel (sub-base).	Dry			
0.50		Brown sandy gravel fine to coarse brick and flint, with some wood fragments.	Dry, NDO.		65 ppm	
0.60		END: 0.6m - refusal on hard concrete obstruction.				

Notes: Hand dug to 0.6 mbl. Backfilled with arisings, concrete at surface.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 20/02/2014  
 Logged By: RV/NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 31.27 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS33**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result
0		MADE GROUND: Concrete with steel reinforcement bar.			
0.15		MADE GROUND: Slightly clayey sandy medium gravel of brick and concrete.			
0.40		MADE GROUND: Soft orange/brown sandy gravelly silt. Gravel is of fine to medium, sub-angular to angular flint.			29.1 ppm
					22.0 ppm
					16.1 ppm
					22.2 ppm
1.15		Grey/beige sandy clayey GRAVEL of fine to coarse flint with some concrete.	Dry, NDO.		
1.30		Brown medium to coarse SAND.	Dry, NDO.		85 ppm
1.40		Becoming clayey SAND.	Dry, NDO.		
		Becoming slightly clayey sandy GRAVEL of fine to coarse, sub-angular to angular flint.			76 ppm
1.60		END: 1.6m - refusal on coarse flint gravel.			
2					

Notes: Hand dug to 1.2 mbgl. Gas well installed.



Client: Alps Group Ltd  
 Project Number: GCU0124024  
 Location: Nestle Hayes  
 Date Drilled: 20/02/2014  
 Logged By: NR  
 Driller: Geotron UK Ltd.

Borehole Elevation: 30.94 maOD  
 Borehole Diameter: 120mm  
 Installation Diameter: 25mm ID  
 Slot Size: 1-2mm  
 Method: Window sample

Borehole Reference:

**WS36**

Coordinates: ,

Depth (m)	Legend	Description	Observations	Sample	Sample / Field Test Result	
0		MADE GROUND: Concrete with steel reinforcement bar.				
0.10		MADE GROUND: Slightly clayey sandy gravel of fine to coarse brick, concrete and stone (mostly flint).  From 0.4 - 0.6m: Older layer of concrete (broken).  At 0.8m: 150x100mm concrete slab.  At 1.1m: Whole and half bricks.	Wet from 0.7m.			
1.20		Sandy GRAVEL of fine to coarse subangular to sub-rounded stone of mixed lithologies (mostly flint).	Wet, NDO. Black staining throughout.		22.3 ppm	
					16.2 ppm	
					12.1 ppm	
					10.0 ppm	
					43ppm	
					52ppm	
					41ppm	
2						
2.10						

Notes: Hand dug to 1.2 mbgl. Gas well installed.



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