DESK STUDY AND GROUND INVESTIGATION

Proposed development at:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON NW3 3NL

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TABLE OF CONTENTS

1.0 INTRODUCTION 2
2.0 THE SITE 2
3.0 DESK STUDY 3
3.1 Historical Maps and Database 3
3.2 Potential Contamination Sources and Environmental Context 10
4.0 GROUND INVESTIGATION 12
5.0 GROUND CONDITIONS 13
5.1 Made Ground 13
5.2 London Clay 13
5.3 Groundwater 14
5.4 Existing Foundations 15
6.0 DISCUSSION 16
6.1 Foundations and Basement Construction 16
6.2 Basement Impact Appraisal 19
6.3 Underpinning foundations for adjoining structures 22
6.4 Ground Movement 22
6.5 Piled Foundations 23
6.6 Foundation Concrete 25
7.0 OUTLINE CONTAMINATION APPRAISAL 25
7.1 Soils 25
7.2 Disposal of Excavated Soils 26
7.3 Ground Gas 26
7.4 Water Supply Pipes 26
7.5 Tabulated Conceptual Model and Risk Assessment 27

APPENDIX A

GROUNDSURE DESK STUDY INFORMATION
6th JUNE 2012

- Ordnance Survey/ National Grid maps – large scale
  Ref. SCL-361222
- Ordnance Survey/ National Grid maps – small scale
  Ref. SCL-361222
- Groundsure EnviroInsight - database and maps
  Ref. SCL-361223
- Groundsure GeoInsight – database and maps
  Ref. SCL-361224

APPENDIX B

GROUND INVESTIGATION

- Foreword to cable percussive drilling
- Borehole record
- SPT results table
- Foreword to window sampling
- Window sample borehole records
- Trial pit records
- Moisture content and Atterberg limit test results
- Plasticity Charts
- Triaxial compression test results
- Undrained shear strength vs depth plot
- Results of sulphate & pH determinations
- Foreword to contamination testing
- Contamination test results
- Proposed development
- Site plan
- Location map

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DESK STUDY AND GROUND INVESTIGATION
THE ADELAIDE, 143, ADELAIDE ROAD, LONDON NW3 3NL

1.0 INTRODUCTION

A site investigation has been carried out by Soil Consultants Ltd in connection with the proposed construction work at The Adelaide, 143, Adelaide Road, located in northwest central London.

The investigation, undertaken in June 2012, aimed to establish the history / environmental setting of the site and the underlying geology and ground / groundwater conditions, to provide data for construction and foundation design along with an outline contamination assessment and waste classification.

This report summarises the results of the desk study and ground investigation carried out. The ground conditions encountered are then described and recommendations for foundation and retaining wall design are provided. The contamination results are then reviewed and a site Conceptual Model is presented.

This Report has been prepared for the benefit of the Client and associated parties directly involved with the design and construction of the project under direction of the Client. No reliance can be assumed by others without written agreement from Soil Consultants Limited.

2.0 THE SITE

The site is located in a mainly residential area of City of Westminster, on the south west corner of the junction between Adelaide Road and Elsworthy Rise, at approximate National Grid Reference 527355E, 184277N. The site is roughly rectangular in area, measuring approximately 44m [N-S] by 17m [W-E]. The surrounding terrain slopes gently down from north to south.

The site comprises The Adelaide, a 4-storey public house situated in the northern part of the site and incorporates a lower ground floor which is at basement level at the front. The garden area to the rear comprises a paved area with lawns and borders and seating areas. There is a raised pathway along the southern boundary, defined by the walls of adjacent residential properties. The western and eastern boundaries are defined by brick walls. Access to the rear garden area is via a gateway off Elsworthy Rise. A bin store is situated on the eastern side of the rear garden.

Residential properties are situated to the west and on the east side of Elsworthy Rise and the north side of Adelaide Road.

Trees are present along the western boundary, including Sycamore, Ash and Beech and there are further small trees and bushes around the southern and eastern boundaries.

Main line railway tunnels are present both immediately north of the site and also a short distance to the south. Survey details giving depths and precise locations have been requested from Network Rail.

The proposed development involves the demolition of The Adelaide and construction of a new 4-storey residential development with a lower ground floor car park, the depth of which will be consistent with the depth of the existing lower ground floor / basement and will extend beneath the whole proposed footprint which extends throughout the southern part of the site. The proposed footprint is therefore substantially larger than the existing Adelaide public house.

3.0 DESK STUDY

3.1 Historical Maps and Database

Historical maps and an environmental database were commissioned from Groundsure, Order Nos. SCL-361222 to SCL-361224, dated 6th June 2012, in order to ascertain the history/usage of the site and surrounding land.

An indication of the gradual development of the site and surrounding area and certain land usages can be gained by a study of the historical maps. A summary of the main observations from the available historical maps and plans [1:1,250 to 1:10,560 scale], which are relevant to this site is presented in Table 1 below:

Table 1 – Historical Development of Site and Surrounding Area

Date	On Site	Surrounding Area
➢ 1866/ 1896	➢ The site was already developed with the current public house shown on the earliest edition of 1866. ➢ There is an additional outbuilding along the eastern side of the site.	➢ Adelaide Road is already well developed with houses by 1866, with farm fields still present to the north. ➢ The road to the east is known as Eton Place. ➢ Eaton & Middlesex Cricket Ground is situated at the end of Eton Place, beyond which is parkland on Primrose Hill. ➢ A pond is shown about 450m SW. ➢ The railway tunnels may have been under construction around 1866 as the tunnel entrances are depicted to the east, but no rail lines. ➢ By 1894 the cricket ground had been redeveloped as housing on King Henry Rd and Elsworthy Road. Houses are shown immediately beyond the southern boundary of the site for the first time. ➢ Former fields to the north have now been subject to residential development. ➢ There is an Air Shaft 250m SW of the site on the 1894 edition, indicative of the nearby railway tunnels, which are fully operational at this time. ➢ A Saw Mill is present c250m NW.

Table 1 – Historical Development of Site and Surrounding Area

Date	On Site	Surrounding Area
➢ 1911/ 1940	➢ The site remains unchanged showing a public house. ➢ The outbuildings are shown as a glasshouse ➢ By 1935 the glasshouse is no longer shown	➢ There is gradual infill development with new houses developing to the south west. ➢ The former Saw Mill has been redeveloped for housing. ➢ The former pond 450m SW is no longer shown, possibly infilled. ➢ By 1935 Eton Mews West to the south of the site are labelled for the first time.
➢ 1952/ 1966	➢ By the 1952 edition, the building is labelled as Eton Hotel.	➢ The 1952 edition depicts the line of the railway tunnels for the first time and they are labelled Primrose Hill tunnels to the S. ➢ A Builder's Yard is shown 20m SW and a Garage is shown 30m E in 1952. ➢ By 1952 Eton Place has been renamed Elsworthy Rise. ➢ The 1966 edition shows that six houses on the north side of Adelaide Road have been demolished
➢ 1969/ 1974	➢ The site remains unchanged showing the Eton Hotel.	➢ There have been substantial changes by 1972, with houses and the Garage on the east side of Elsworthy Rise and on the north side of King Henry Road demolished to make way for new residential development called Quickswood and Conybeare. ➢ An electricity sub-station is shown 150m E. ➢ Further houses along Adelaide Rd have been demolished and now make way for new residential blocks of Bray and Dorney on the north side of Adelaide Rd. ➢ The Builder's Yard is no longer shown.
➢ 1985/ 1991	➢ The site remains unchanged but the premises are now called The Viceroy.	➢ Elliott Square residential development has been constructed to the W and SW and Brocas Close, Huson Close and Briary Close developments have been constructed on the north side of Adelaide Rd. ➢ Air shafts are shown on the 1989 edition about 218m E
➢ 2002/ present	➢ The site remains unchanged showing the public house.	➢ There is no significant new development in the immediate locality during this period

The relevant historical maps are included in the Appendix.

The desk study takes into account information included in a database of local activities; this database encompasses a range of subjects related to land use, pollution, and geological/hydrological conditions.

A summary of the relevant contaminative uses and other environmental issues identified by the Groundsure report, within 250m of the site [unless stated otherwise], is presented in Table 2 below:

Table 2 – Database Summary			
Type	**Map ID.**	**Distance / direction**	**Description**
Environmental Permits, Incidents and Registers			
Industrial Sites Holding Licences and/or Authorisations			
Records of historic IPC Authorisations	-	>250m	➢ No record within 500m of site
Records of Part A(1) and IPPC Authorised Activities	-	>250m	➢ No record within 500m of site
Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	-	>250m	➢ No record within 500m of site
Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	-	>250m	➢ No record within 500m of site
Records of List 1 Dangerous Substances Inventory Sites	-	>250m	➢ No record within 500m of site
Records of List 2 Dangerous Substances Inventory Sites	-	>250m	➢ No record within 500m of site
Records of Part A(2) and Part B Activities and Enforcements	-	>250m	➢ Nearest record is 310m NE Dry cleaners
Records of Category 3 or 4 Radioactive Substance Licences	-	>250m	➢ No record within 500m of site
Records of Licensed Discharge Consents	-	>250m	➢ No record within 500m of site
Records of Planning Hazardous Substance Consents and Enforcements	-	>250m	➢ No record within 500m of site
Dangerous or Hazardous Sites			
Records of COMAH & NIHHS sites	-	>250m	➢ No record within 500m of site
Environment Agency Recorded Pollution Incidents			
Records of National Incidents Recording System, List 2	-	>250m	➢ No record within 250m of site
Records of National Incidents Recording System, List 1	-	>250m	➢ No record within 250m of site
Sites Determined as Contaminated Land under Part IIA EPA 1990			
Sites Determined as Contaminated Land under Section 78R of the Environmental Protection Act 1990	-	>250m	➢ No record within 500m of site

Table 2 – Database Summary

Type	Map ID.	Distance / direction	Description
Landfill and Other Waste Sites			
Landfill Sites			
Records from Environment Agency Landfill Data	-	>250m	➢ No records within 1km of site
Records of Operational Landfill Sites	-	>250m	➢ No records within 1km of site
Records of Environment Agency Historic Landfill Sites	-	>250m	➢ Nearest is 1,361m W Canfield Place, London NW6
Records of Non-operational Landfill Sites	-	>250m	➢ No records within 1km of site
Records of BGS/DoE Non-operational Landfill Sites	-	>250m	➢ No records within 1.5km of site
Records of Local Authority Landfill Sites	-	>250m	➢ No records within 1.5km of site
Other Waste Sites			
Records of Operational or Non-operational Waste Treatment, Transfer or Disposal Sites	-	>250m	➢ No records within 500m of site
Records of Environment Agency Licensed Waste Sites	-	>250m	➢ Nearest is 1,318m E Household Waste Amenity Site Jamestown Road
Current Land Use			
Current Industrial Data			
Records of Potentially Contaminative Industrial Sites	1 2 3 4 5 6 7 8 9 10	56m SE 103m W 112m E 134m W 136m W 220m S 225m W 232m E 248m W 250m NW	➢ Special Purpose Equipment ➢ Furniture ➢ Electricity Sub Station ➢ Electricity Sub Station ➢ Stationery ➢ Electricity Sub Station ➢ Sports and Leisure Equipment ➢ Electricity Sub Station ➢ Electricity Sub Station ➢ Electricity Sub Station
Petrol and Fuel Sites			
Petrol and Fuel Sites	-	>250m	➢ No record within 500m of site
Underground High Pressure Oil and Gas Pipelines			
High Pressure Underground Pipelines	-	>250m	➢ No record within 500m of site

Table 2 – Database Summary	
Hydrogeology and Hydrology	
Aquifer Within Superficial Deposits	➢ No records in proximity to the property
Aquifer Within Bedrock Deposits	➢ 'Unproductive' on site
Groundwater Abstraction Licences	➢ Nearest record is 543m W Spray Irrigation
Surface Water Abstraction Licences	➢ Nearest record is 1,147m E Non-Evaporative Cooling
Potable Water Abstraction Licences	➢ Nearest record is 631m SE Barrow Hill Pumping Station
Source Protection Zones	➢ On site – Source Protection Zone 2 – Outer Catchment ➢ 334m SE – Source Protection Zone 1 - Inner
River Quality	➢ No records within 1.5km of site
Detailed River Network	➢ St Agnes's Well 164m W – Extended Culvert
Surface Water Features	➢ No records within 250m of site
Flooding	
Zone 2 Flooding [annual 0.1% probability or greater from rivers and the sea but less than 1% from rivers or 0.5% from the sea]	➢ No records within 250m of site
Zone 3 Flooding [annual 1% probability or greater from rivers and 0.5% or greater from the sea]	➢ No records within 250m of site
Flood Defences	➢ No flood defences within 250m of site
Areas Benefitting from Flood Defences	➢ No records within 250m of site
Areas Used for Flood Storage	➢ No records within 250m of site
Groundwater Flooding Susceptibility Areas	➢ Groundwater Flooding Susceptibility Areas present within 50m of the site; negligible susceptibility

Table 2 – Database Summary

Type	Description
Designated Environmentally Sensitive Sites	
Type	**Description**
Presence of Designated Environmentally Sensitive Sites	➢ None present within 500m of site
Records of Sites of Special Scientific Interest [SSSI]	➢ None present within 500m of site
Records of National Nature Reserves [NNR]	➢ None present within 500m of site
Records of Special Areas of Conservation [SAC]	➢ None present within 500m of site
Records of Special Protection Areas [SPA]	➢ None present within 500m of site
Records of Ramsar Sites	➢ None present within 500m of site
Records of Local Nature Reserves [LNR]	➢ None present within 500m of site
Records of World Heritage Sites	➢ None present within 500m of site
Records of Environmentally Sensitive Areas	➢ None present within 500m of site
Records of Areas of Outstanding Natural Beauty [AONB]	➢ None present within 500m of site
Records of National Parks [NP]	➢ None present within 500m of site
Records of Nitrate Sensitive Areas	➢ None present within 500m of site
Records of Nitrate Vulnerable Zones	➢ None present within 500m of site
Geology, Landslips, Faults and Radon	
Type	**Description**
Artificial Ground and Made Ground	➢ No record within 500m of site
Permeability of Artificial Ground	➢ No record within site boundary
Superficial Ground and Drift Geology	➢ No record within 500m of site
Permeability of Superficial Ground	➢ No record within site boundary
Landslips	➢ No record within 500m of site
Landslip Permeability	➢ No record within site boundary
Bedrock and Solid Geology	➢ London Clay – on site
Permeability of Bedrock Ground	➢ Very low to moderate permeability Flow type – mixed flow
Faults	➢ No record within 500m of site
Radon	➢ The property is not in a Radon affected area as less than 1% of properties are above the action level. Radon protection measures are not necessary

Table 2 – Database Summary			
Ground Workings			
Historical Surface Ground Working Features Derived from Historical Mapping [within 250m of site]	1A-2A	174m E	➢ Cuttings – 1957 & 1968
Historical Underground Workings Features Derived from Historical Mapping [within 1000m of site]	3B-6B 7-10C 11D-14D 15 16E-21E	On site 7-8m S 99m–101m SE 218E 259m SW	➢ Tunnels ➢ Tunnels ➢ Tunnels ➢ Air shaft ➢ Air shaft
Current Ground Workings	-	>250m	➢ No records within 1km of site
Mining, Extraction & Natural Cavities			
Historical Mining	1 2A-7A	218m E 259m SW	➢ Air shaft ➢ Air shaft
Coal Mining	-	>250m	➢ No records within 1km of site
Johnson Poole and Bloomer	-	>250m	➢ No records within 1km of site
Non Coal Mining	-	>250m	➢ No records within 1km of site
Non Coal Mining Cavities	-	>250m	➢ No records within 1km of site
Natural Cavities	-	>250m	➢ No records within 1km of site
Brine Extraction	-	>250m	➢ No records within 1km of site
Gypsum Extraction	-	>250m	➢ No records within 1km of site
Tin Mining	-	>250m	➢ No records within 1km of site
Clay Mining	-	>250m	➢ No records within 1km of site

Table 2 – Database Summary			
Natural Ground Subsidence			
Natural Subsidence – Maximum Hazard Rating	-	Site	➢ Moderate Hazard
Shrink Swell – Maximum Hazard Rating	1	Site	➢ Moderate Hazard
Landslides – Maximum Hazard Rating	1	Site	➢ Very Low Hazard
Soluble Rocks – Maximum Hazard Rating	1	Site	➢ Null-Negligible Hazard
Compressible Ground – Maximum Hazard Rating	1	Site	➢ Negligible Hazard
Collapsible Ground – Maximum Hazard Rating	1	Site	➢ Very Low Hazard
Running Sand – Maximum Hazard Rating	1	Site	➢ Negligible Hazard
Borehole Records			
BGS recorded boreholes	1A-16	38m N to 208m S	➢ 16No records
Estimated Background Soil Chemistry			
Records of Background Estimated Soil Chemistry [within 250m of site]	-	Site	➢ No data

3.2 Potential Contamination Sources and Environmental Context

The available records reviewed as part of the desk study indicate that the site was already developed as a public house / hotel by the earliest edition of the historical maps in 1866.

There has been gradual residential infill development / redevelopment of the locality since then.

The site is underlain by an 'Unproductive' Aquifer, namely the London Clay. There is a Source Protection Zone 2 beneath the site, but this is within the Chalk at depth, which is protected by the overlying London Clay of substantial thickness.

There are no recorded Landfills within 250m of the site and Radon protection measures will not be required.

Overall the site is considered to be located in an area of low sensitivity based on the desk study information obtained.

There are electricity sub-stations given in the database within 250m and other minor commercial activities. There was a Builder's Yard and a Garage to the southwest and east, respectively, on the historical maps of the 1950s and 1960s. The relatively low permeability of the London Clay should ensure that these features have not presented any significant risk to the new development.

Overall, we have not observed any evidence of current activities within the site or immediate surroundings that are likely to pose a source of significant ground or groundwater contamination.

The risk of soil or groundwater contamination resulting from known past and current activities at the site and in the general site area is therefore considered to be 'Low Risk'.

Geotechnical issues raised by the database and maps are firstly, that shrinking and swelling clay is given as a Moderate Hazard which is due to the London Clay. Significantly, railway tunnels are present immediately north and to the south of the site, and the effects of the development on the tunnels will require a separate assessment.

4.0 GROUND INVESTIGATION

The exploratory work by Soil Consultants Ltd was undertaken between 8th & 22nd June 2012, with the aim of providing geological, geotechnical, hydrogeological and contamination information for the proposed scheme. Exploratory positions were restricted to the rear garden area due to the proximity of railway tunnels at the northern frontage. Ground levels at the borehole positions are based on values given on the site plan provided by the Engineer.

The investigation comprised the following elements:

Window sample boreholes

Three (3No) window sample boreholes, up to 5m deep [Boreholes WS1 to WS3] were constructed in the rear garden and terminated within the natural London Clay. These boreholes provide a near-continuous soil profile, which was logged by one of our geotechnical engineers and sampled for laboratory testing. In addition, shear strength testing was undertaken using a hand vane and hand penetrometer.

Cable percussive boreholes

A cable percussive borehole [BH1] was constructed in the rear garden. BH1 terminated at a depth of 20m, terminating within the competent London Clay. Standard Penetration Tests [SPT] alternating with relatively undisturbed U100 samples, were undertaken [generally at 1.0m to 1.5m centres].

Hand excavated trial pits

Nine (9No) trial pits were hand excavated adjacent to the boundary and basement walls with the aim of exposing the existing foundations.

Laboratory testing

All samples collected from the boreholes were taken to our geotechnical laboratory for moisture content, plasticity, undrained triaxial, pH and sulphate testing.

In addition, 3No soil samples were despatched to a specialist laboratory for testing for a range of commonly-occurring potential contaminants. A further sample was tested for Waste Acceptance Criteria (WAC).

Our exploratory records and laboratory test results are included in Appendix B. A Site Plan which shows the exploratory locations is also appended.

5.0 GROUND CONDITIONS

Prior to the intrusive investigation, reference to the geological map of the site area and our previous experience in this part of London indicated that the site is likely to be underlain by London Clay [typically medium to very high strength fissured clay], extending to significant depths. Given the developed nature of the site, some made ground was also expected.

Our investigation has confirmed the expected geology, encountering variable made ground overlying London Clay. Groundwater was not encountered as BH1 was drilled but seepages were recorded within the window sample boreholes and significant standing water, possibly trapped surface water was evident in TP6 to TP9 in the basement.

5.1 Made Ground

Made Ground was present in all exploratory positions to depths of between 0.7m (WS3) and 2.2m (WS1). This soil comprises variable strength dark brown, black, grey and orange brown clay with gravel size fragments of brick, flint and occasional clinker, mortar, ash and rootlets.

A lesser thickness of Made Ground was found in TP6 to TP9, which were excavated at the lower level in the basement / lower ground floor.

The variable strength of this deposit is primarily due to the means of deposition by man. The influence of nearby trees will also have contributed to moisture variations and the variable strength.

5.2 London Clay

The surface of the London Clay was encountered beneath the Made Ground in all boreholes, at depths ranging between 0.7m and 2.2m. Medium to high strength brown and blue grey / orange brown fissured clay was found to the full depths of the window sample boreholes and in BH1. Selenite crystals were found within the clay, generally between 4.5m and 8.5m depth.

Rootlets were seen to depths of 1.2m, 1m, 1.7m and 1.6m below ground level in BH1, WS1, WS2 & WS3, respectively. Field strength and laboratory moisture and strength testing has shown that these upper layers are desiccated in WS2 and WS3, which were located along the western side of the site nearest to the substantial Ash trees.

The deeper BH1 encountered high strength brown and blue grey fissured clay with occasional selenite crystals to a depth of 8.6m below ground level. Below 8.6m depth the clay is high strength grey fissured clay, becoming very high strength below about 18m depth.

The results of Atterberg limit tests on the London Clay are shown in Appendix B, classifying this soil as High Volume Change Potential (PI>40%) in accordance with NHBC Standards.

Hand penetrometer measurements in the field generally indicated a medium to high strength [typical C_u from 50kN/m^2 to 150kN/m^2] in the window sample boreholes. Laboratory undrained triaxial shear strength testing on nominal 100mm diameter samples from BH1 [see Appendix B] gave a range of shear strength values varying between 62kN/m^2 at 2.50m depth to 146kN/m^2 at 16.5m depth. The strength recorded on the sample recovered from 19.5m depth was somewhat lower than expected; this scatter is typical of the London Clay where local fissuring tends to influence the results.

In situ SPT results in the London Clay [see Appendix B] ranged between 'N'=9 and 'N'=33, confirming a medium strength to very high strength. The appended graph of SPT 'N' and Cu against elevation has included a correction for the efficiency of the SPT Hammer in accordance with BS-EN 1997 [Eurocode 7]. A conversion factor of 4 has been used between 'N'-value and undrained shear strength.

5.3 Groundwater

BH1 remained dry during drilling but seepages were recorded at depths of 2m to 2.2m at the base of the Made Ground in WS1, 3.1m to 3.2m depth at a claystone in WS2 and at 0.7m depth at the base of the Made Ground in WS3. The observations in WS1 and WS3 show that trapped water may be present within the lower part of the Made Ground. The more substantial seepage was in WS1 where the base of the Made Ground was deepest at an elevation of +5.9m SD. This compares with the elevation of the minor seepage in WS3 at an elevation of +7.5m SD. Standing water was also evident in TP3 at founding level of 1m below ground level (+7.2m SD).

Standing water was evident at elevations of between +7.30m SD and +7.08m SD in TP6 to TP9 excavated within the lower ground floor / basement. This may be due to surface water and drainage water collecting around the building foundations.

Seasonal and other variations in groundwater level can occur, with higher levels likely during wetter periods of the year. Although this factor may not be significant in terms of the underlying groundwater table, which appears to be well below proposed basement level, seasonal variations may influence the shallow zones of trapped surface water.

5.4 Existing Foundations

Trial Pit	Founding Depth	Remarks
TP1	1.75m BGL	Southern boundary – possible natural ground
TP2	1.55m BGL	Southern and western boundary – possible natural ground
TP3	1.00m BGL	Eastern boundary – founded on Made Ground
TP4	0.63m BGL	Western boundary – founded on Made Ground
TP5	-	Low height wall built off paving
TP6	0.20m BBFL	Lower ground floor – possible Made Ground
TP7	0.35m BBFL	Lower ground floor – founded on Made Ground
TP8	0.44m BBFL	Lower ground floor – founded on natural
TP9	0.60m BBFL	Lower ground floor – founded on natural

6.0 DISCUSSION

This ground investigation has provided general coverage of the proposed scheme which involves construction of a four storey residential development with lower ground floor car park. Finished levels have not been finalised, but the elevations provided show that the basement car park will be at a similar elevation (+7.3m SD) to the current lower ground floor / basement. This means that an excavation of about 1m (increasing slightly at the southern extremity where existing levels are slightly raised) will be required within the majority of the current rear garden area to accommodate the proposed lower ground floor car park level.

Initial outline proposals provided by the Engineer have indicated that the structure is likely to masonry or precast concrete ‘cross wall’ construction with timber or precast concrete suspended floors. Foundations loads are expected to be approximately 300-350kN/m for strip footings and ground beams. Underpinning is likely to be required to transfer loads, from the adjacent properties to the south, down to foundations below the proposed lower ground floor.

Our investigation has revealed that the basement excavation would intercept Made Ground initially, followed by London Clay. Some of the excavation formation level will be within Made Ground (WS1 near the southern boundary), whilst London Clay is likely to be exposed at formation level in the northern parts of the site. London Clay is expected to extend to depths well below the excavation formation level.

Groundwater has not been present within the deep BH1 which shows that the general groundwater table is well below proposed lower ground floor level. However, we have found substantial amounts of trapped surface water, both within the Made Ground beneath external areas and in the vicinity of existing building foundations. Inflows can therefore be expected during demolition / grubbing out of old foundations and during the excavation of the proposed lower ground floor.

6.1 Foundations and Basement Construction

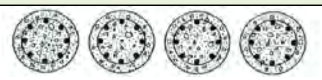
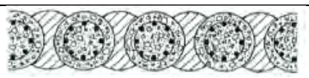
We understand that much of the proposed lower ground construction will be built within an open excavation, but a piled retaining wall may be required around the northern boundaries where the excavation sidewall height of about 3m will require support to minimise movements.

The underlying groundwater table is expected to be below the proposed lower ground floor level but we have found evidence of trapped surface water within the Made Ground and around existing foundations. We therefore recommend that measures are taken to seal out groundwater from within the basement construction.

Adequate drainage and waterproofing should, of course, be incorporated in the design to ensure that groundwater and water from burst water mains or leaking drains does not adversely affect the structure.

As a cross-wall construction is proposed there will be a requirement for the loads from the main structure to be supported at lower ground floor level by internal strip / spread foundations or alternatively by additional internal piles.

Various types of embedded wall are used for basement construction. The different options are compared briefly in the following table:

Table 3 – Review of embedded wall types		
Wall Type	**Indicative section**	**Comments**
Contiguous pile wall		Gap of approximately 150mm between piles, allowing relatively uncontrolled percolation of groundwater. Fines could wash through the wall where granular materials exist causing ground loss.
Interlocking pile wall		Unreinforced primary piles, constructed from 'soft' concrete mix. Reinforced concrete secondary piles. Provides temporary water barrier only due to limited durability of 'soft' piles.
Secant pile wall		Primary piles constructed from structural concrete; can be unreinforced or sometimes reinforced in poor ground or for large vertical spans.
Steel sheet pile wall		Steel pile sections either driven or jacked ('pressed') into the ground. Clutches can be welded to provide additional protection against groundwater ingress.

Interlocking or secant pile walls are commonly selected for deep basements due to a combination of economic and technical considerations and may be suitable for this project. The piles could then be used also to support the structural loads.

The use of a contiguous piled wall is not recommended due to the expected ingress of water into the excavation through the gaps in the piles from trapped water within the Made Ground.

The use of driven sheet piling is unlikely to be permitted given the residential site setting; however, silent/vibration-free techniques may be feasible.

Whichever retaining wall system is considered, this may require both temporary and permanent propping. It is recommended that the advice of a specialist contractor is sought at an early stage to ascertain the most suitable and cost-effective retaining system for this project.

In the permanent case the lateral earth pressures can either be supported by the retaining wall piles, or by an RC basement structure within the perimeter piles. In either case horizontal support will be provided by the new ground and basement slabs.

Lateral wall deflections and settlement behind the wall can both be minimised by careful and diligent construction and by suitable propping arrangements.

Recommended geotechnical parameters are shown below [Table 4]. These parameters have been obtained from our best estimates of the known properties of the soils in this locality and on the basis of our ground investigation.

Table 4 – 'most probable' best estimates of geotechnical parameters [partial material factors not applied]

Stratum	Expected Elevation of Base of Stratum	Effective angle of friction [ϕ']	Effective cohesion (c')	Bulk unit weight [γ_b]
Made ground	+5.9m SD to +7.5m SD	Typically 23°	0kN/m^2	18kN/m^3
London Clay	Proven to -11.8m SD	Typically 23°	Typically 0kN/m^2; increase to 5kN/m^2 after 5m embedment	20kN/m^3

In general terms Eurocode 7 (EC7) stipulates that partial material factors must be applied to the best estimates of geotechnical soil properties during the design stage. The design engineer must ensure that the correct comparisons are made between Design Effect of Actions and Design Resistances after the application of partial material factors.

EC7 gives little detailed guidance on the design of embedded retaining walls, although partial material and load factors are defined. As far as we are aware, traditional national practice may therefore still play a large part in their design for the time being, which would be CIRIA C580 – 'Embedded retaining walls- guidance for economic design', for which the parameters given in Table 4 can equally be referred to. This position should be reviewed during the timeframe of the development design.

The wall designer should use these parameters to derive the active and passive earth pressure coefficients, Ka and Kp. The determination of appropriate earth pressure coefficients, together with factors such as the pattern of earth pressure distribution, will depend upon the final type/geometry of the wall and the overall design approach.

The retaining wall piles may also be used to support vertical loads if required [see Section 6.4] subject to the necessary allowance being made for interaction effects.

Substantial mature trees are present on the western boundary and small trees and bushes are present around the rear garden and on the Elsworthy Rise footpath. We have found evidence of desiccation, typically to depths of 1.6m / 1.7m in WS2 and WS3. The London Clay exhibits a High Volume Change Potential, which means that the possibility cannot be discounted that clay heave may occur if trees are removed in the future from within influencing distance of the lower ground floor. Incorporation of a compressible medium against the outside face of the retaining wall, particularly on the western side may help to reduce possible effects of lateral clay heave.

6.2 Basement Impact Appraisal

This assessment consists of hydrological/hydro-geological and land stability appraisals. The screening stage for land stability has been considered as set out in Table 5 below.

Table 5 Impact of proposed basement works on Land stability

Impact question	Answer	Justification	Reference
1)Does the existing site include slopes, natural or man made greater than 7 degrees [approximately 1 in 8]?	No	There is a gentle slope of less than about 3 degrees	Measurement from topographic data and on-site inspection
2) Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7 degrees?	No	There are no plans to alter these site levels	Site plans
3) Does the development neighbour land, including railway cuttings and the like with a slope greater than 7 degrees?	No	No evidence of such features	Desk study and walkover
4) Is the site within a wider hillside setting in which the general slope is greater than 7 degrees?.	No	No evidence of such features	Desk study and walkover
5) Is the London Clay the shallowest strata at the site?	No	There are surface layers of Made Ground	Section 5 and borehole records
6] Will any trees be felled as part of the proposed development and/or any works proposed within any tree protection zones where trees are to be retained?	Unknown	Trees will be removed from rear garden area for proposed construction. Other trees presently growing along site boundaries	Site plans
7] Is there a history of seasonal shrinkage/swelling subsidence to the local area, and or evidence of such effects at the site?.	Yes	Moderate hazard identified in desk study and boreholes found evidence of desiccated clay soils	Section 5 and borehole records
8) Is the site within 100m of a watercourse or a potential spring line?	No	No records within 250m	Desk study and walkover
9] Is the site within an area of previously worked ground	No	Localised made ground only met. Tunnels present to north and south	Desk Study, Section 5 and borehole records

Impact question	Answer	Justification	Reference
10] Is the site within an aquifer?.	No	Localised water met in exploratory holes due to seepages from Made Ground. Groundwater control required to deal with substantial inflows from trapped water	Section 5 and borehole records
11] Is the site within 5m of a highway or pedestrian right of way?	Yes	Pedestrian footpaths along Adelaide Rd and Elsworthy Rise	Site plans
12] Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties	Yes	Levels will be reduced in current rear garden area to accommodate proposed lower ground floor	Site plans
13] Is the site over [or within the exclusion zone of] any tunnels, eg railway lines	Yes	Railway tunnels immediately north and to south of site	Desk study

Provided the recommendations detailed in our report are adhered to we assess low risk with regards to land stability as a result of the proposed development. A ground movement analysis will be required in order to assess the impact of the proposed development on the adjacent tunnels.

We have also considered the potential impact of the proposed basement development on surface water flow, flooding and groundwater flow.

Table 6 Impact of proposed basements works on surface water

Impact question	Answer	Justification	Reference
1) As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	As far as we are aware there are no plans to change the route for site drainage.	Site plans.
2) Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	The proposed works include a larger residential block and may result in an increase in sewerage discharge volume from the property.	Site plans.
3) Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	There are no existing surface water features on the property or nearby.	Desk study
4) Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	There are no existing surface water features on the property or nearby. It is highly unlikely that there will be an impact on surface water quality as a result of the proposed development.	Desk study
5) Is the site in an area known to be at risk from surface water flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	No	The site is not in an area with the potential to be at risk of surface water flooding.	Desk study

Table 7 Impact of proposed basement works on groundwater

Question	Answer	Justification	Reference
1a) Is the site located directly above an aquifer?	No	The London Clay Formation is designated as 'Unproductive strata' by the Environment Agency (i.e. non-aquifer). The London Clay Formation at this site is understood to be of significant thickness, well below the influence of the proposed development	Desk study
1b) Will the proposed basement extend beneath the water table surface?	No	Basement works will extend to a maximum of about 3.5m below the ground surface. The prevailing groundwater table is likely to be well below proposed basement level.	Desk study
2) Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	No	The site is over 250m distance from any existing known water feature	Desk study
3) Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	The proposed works include a larger residential block and may result in an increase in sewerage discharge volume from the property.	Site plans
4) As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	Existing drainage arrangements will be unchanged. Soakaways will not function effectively in this area due to the low permeable nature of the subsurface	Site plans
5) Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond or spring line.	No	The lowest point of the excavation is understood to be around +7.3m ASD. There are no local ponds or surface water features within 250 m of the site.	Desk study

The proposed development site is underlain by a thin layer of Made Ground, the majority of which is likely to have been derived from the underlying London Clay Formation (i.e. clay), thus is unlikely to transmit significant quantities of water.

Underlying the Made Ground is a substantial thickness of London Clay Formation which is highly unlikely to transmit significant quantities of water. It is expected that there will be negligible water ingress from the London Clay Formation during the excavation stage. Therefore, it is considered that the proposed development site is likely to have a negligible impact on groundwater flow in the London Clay Formation.

There are no known wells, springs or potential spring lines or surface water features within 250m of the site.

The proposed development site lies on a significant thickness of London Clay Formation which is an unproductive aquifer, thus, the proposed development is considered to have a negligible impact on groundwater quality.

The site is not within a designated flood plain. There will be an increase in the extent of impermeable surfaces due to there being a larger residential block. However it is considered that peak runoff from the proposed development will be similar to existing peak runoff rates given that the subsoils are clay based and have a low infiltration capacity.

From the available information, it is unlikely that significant quantities, if any, groundwater is present at the site at depths which will be reached by the proposed development. It is highly unlikely that there will be any discernible impact on groundwater flow or quality.

6.3 Underpinning foundations for adjoining structures

The foundations for the existing property adjacent to the southern boundary are founded at about +6.75m SD to +6.85m SD. Piled foundations will be required for the proposed development so new foundation excavations may not extend significantly below the elevation of the adjacent existing foundations. Underpinning on the southern boundary may not, therefore, be required.

In the event that underpinning is required for the adjoining foundations, these should bear within London Clay and for design purposes we have derived Design Resistances (Rd) by employing Ultimate Limit State (ULS) Design Approach 1 (DA1), Combinations 1 and 2, in accordance with EC7.

The ULS Design Resistances are unlikely to be the critical resistance values as we have also checked for Serviceability Limit State (SLS). For underpinning foundations constructed within the natural London Clay, below any desiccated or root infested soils, an SLS Design Resistance (Rd) of 110kN/m^2 can be adopted. At this bearing pressure, settlements for moderate sized foundations should remain within normally tolerable limits.

Foundation excavations may encounter significant seepages from trapped surface water. Foundation concrete should be cast as soon as practicable following excavation or alternatively a blinding layer placed to prevent softening or drying out. The formation should be carefully inspected for soft spots for which local deepening should be carried out.

6.4 Ground Movement

The current investigation and report do not include a detailed ground movement analysis, which will be required in order to assess construction-induced ground movements and their effect on the railway tunnels. Basement excavation will cause some minor unloading of the strata resulting in long-term heave in the London Clay, and this will have to be taken into consideration in the design.

The magnitude of the heave pressure/movement will be determined by a number of factors such as slab stiffness, construction programme duration and the restraining effects of any axially loaded piles.

We have carried out a preliminary assessment of heave effects in relation to the design of the basement slab for which the excavation unload will vary from about 20kN/m^2 to 30kN/m^2. We therefore estimate that total unconstrained heave could be of the order of 30mm at the centre of the excavation. About 50% of this total movement would be expected to occur prior to construction of the slab leaving about 15mm of potential long-term post-construction heave.

A reasonable assumption is that the relationship between heave movement and pressure is linear, so the maximum heave pressure for a very stiff rigid slab could therefore be about 15kN/m^2 for the fully constrained condition. However, the heave pressure beneath a more flexible slab will be less [due stress dissipation as the slab deflects] and we anticipate that an 'average' stiffness slab would experience heave pressures of the order of 7kN/m^2.

Traditionally it has been normal practice to allow for a groundwater head of 1m below ground level in which case the potential hydrostatic uplift pressure on the basement slab would therefore be about 30kN/m^2 at the northern end of the site where there is an existing lower ground floor / basement. It is important to note that the water pressure will not be additional to any soil heave pressures - the minimum uplift pressure should be adopted for design purposes. It is likely in this case that the assumed hydrostatic pressure on the slab will therefore be more critical than the heave pressure due to excavation unload.

6.5 Piled Foundations

The near surface London Clay will only provide an allowable bearing pressure of the order of 110kN/m^2 to 150kN/m^2 which is unlikely to be sufficient for suitably sized spread foundations for the proposed construction so piled foundations will be required.

Bored or augered piles may be utilised to carry internal wall and column loads. Examples of pile working loads provided are for illustration purposes only and are not intended to recommend a specific pile diameter, pile type or length.

A graph is appended showing the laboratory undrained triaxial test results and SPT N-values (converted to equivalent shear strength using the relationship 4 x N = c_u) in the London Clay. Our recommended design line is also shown representing a linear increase in shear strength at a rate of 6.3kN/m^2 per metre, from 56kN/m^2 at the top of the stratum at +6.4m SD to 160kN/m^2 at -10.0m SD.

The parameters below have been used to assess the ultimate capacity of the new piles, based on the appended combined plot design line for SPT 'N' and C_u v depth.

Shaft adhesion

Stratum	Depth	Ultimate unit shaft friction/ adhesion 'qs'
Made Ground	GL to 2.2m	Ignored in our calculations
London Clay	2.2m to >20m	28kN/m^2 at +6.4m SD increasing linearly to 80kN/m^2 at -10.0m SD

Notes:

a] unit shaft adhesion incorporates α = 0.50, where 'q_s' = α x cu

End bearing

Stratum	Depth	Ultimate unit base resistance 'qb'
London Clay	-8.7m SD to -11.7m SD	Ignored for small diameter piles; use 1,355kN/m^2 at -8.7 SD increasing linearly to 1,525kN/m^2 at -11.7m SD for piles up to 600mm diameter in London Clay

We have used partial factors for Combinations 1 and 2 (C1 & C2) of Design Approach 1 in accordance with the UK National Annex of EC7) to obtain the Design Compressive Resistances (Rcd) given below for 300mm & 450mm diameter bored piles. An α value of 0.5 has been used for these calculations together with Nc = 9.0. We have used partial factors of 1.0 (shaft & base for C1), 1.6 (shaft for C2) and 2.0 (base for C2) and 1.4 (model factor for C1 & C2). Lower partial factors may be acceptable if pile load tests are undertaken but these are unlikely to be cost-effective for the proposed scale of works.

Pile diameter [mm]	Pile toe [m SD]	Ultimate load [kN]	Rcd (C1) [kN]	Rcd (C2) [kN]
300	- 8.7	848	606	370
	-11.7	1086	776	475
450	- 8.7	1344	960	581
	-11.7	1710	1221	742

Notes:

a] Rcd is calculated using Partial factors of 1.0 (shaft & base for C1), 1.6 (shaft for C2) and 2.0 (base for C2) and 1.4 (model factor for C1 & C2).

b] concrete stress should be considered in the final design

There are a number of alternative pile types which may also be suitable subject to consultation with pile specialists. A suitably experienced contractor/engineer should carry out the final design of the new piles.

6.6 Foundation Concrete

A wide range of concentrations of soluble sulphates and near neutral pH values were measured on a number of Made Ground and natural soil samples. The higher soluble sulphate results would appear to be due to the selenite crystals evident within the London Clay. The results are shown in Appendix B, falling into Site Design Class DS-3 of Table C1 given in BRE Special Digest 1:2005, 3rd Edition [Concrete in aggressive ground]. We assess the site to have static groundwater conditions. Our recommendation is therefore that buried concrete should be designed in accordance with ACEC Site Class AC-2s.

Due to the anticipated piling solution, disturbance of the London Clay is unlikely and thus pyrite oxidation [which can raise sulphate levels in the soil] is not considered to be of concern.

7.0 OUTLINE CONTAMINATION APPRAISAL

Contamination testing was carried out specifically for the purpose of providing a general guidance evaluation for the proposed development. Reference should be made to the foreword to the appended contamination test results in order to fully understand the context in which this discussion should be viewed. This appraisal adopts the current UK practice which generally uses the Source-Pathway-Receptor methodology to assess contamination risks. For a site to be designated as contaminated a significant pollutant linkage must be identified between any potential sources and receptors. In considering the potential for contamination to cause a significant effect, the extent and nature of the potential source are assessed and pathways/receptors identified; without an SPL there is theoretically no risk to the receptors from contamination.

7.1 Soils

In order to identify potential on-site contamination, 3No soil samples from the Made Ground were dispatched to a specialist laboratory to be tested for a range of commonly occurring contaminants. The results were assessed where relevant against the DEFRA Soil Guidance Values [SGV] and, where not available, the LQM/CIEH Generic Assessment Criteria [GAC]. It should be noted that the regulatory regime put in place by DEFRA and the Environment Agency has been under review for some time. Revised SGVs are being published from time to time, and depending on the final timing of this proposed scheme there may be a future local authority requirement to re-evaluate the results of this investigation.

In assessing the results we have, where relevant, used the trigger levels for residential end use. The test results are shown in Appendix B. The majority of the measured concentrations fell below the relevant threshold concentrations indicating that significant soil contamination is not present. Many of the determinands were below test detection levels.

The only exceptions were three elevated values of Lead of 849mg/kg, 497mg/kg and 2,222mg/kg in WS1, WS2 and WS3, compared with the former SGV of 450mg/kg. As some of the Made Ground will be removed during redevelopment and as the whole of the site will comprise buildings and hard cover, there would not appear to be a significant pollutant linkage between these elevated values and end users of the site. The London Clay, which is practically impermeable, will provide a suitable barrier so that there should be no significant risk to controlled waters.

7.2 Disposal of Excavated Soils

Waste Acceptance Criteria (WAC) testing was undertaken and these results along with the standard suites can be used to classify the soils for safe disposal.

Made Ground from within the basement excavation is likely to be classified as 'Non-Hazardous'. Ultimately, however, soil for disposal off-site must be classified to the satisfaction of the waste regulation authorities or a licensed waste disposal site.

In view of current guidance, there may be cost benefits in pre-treatment of the waste materials by separating the made ground from the natural [& inert] soils prior to removal off site.

7.3 Ground Gas

There are no recorded Landfills within 250m of the site and Radon protection measures will not be required. We found no evidence of significant biodegradable soils in our ground investigation. Ground gas protection measures are therefore not considered necessary.

7.4 Water Supply Pipes

Another separate issue with regard to potential ground contamination is the specification of water supply pipes. We have referred to the UK Water Industry Research (UKWIR) publication Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, 2011.

Barrier pipework is unlikely to be required at this site as we have found no evidence of significant hydrocarbon contamination. Approval should be obtained from the water supply company before supply pipes are installed in order to confirm costing and pipe selection.

7.5 Tabulated Conceptual Model and Risk Assessment

Taking into account the above discussion, the assessed risks to potential receptors are summarised as follows:

Conceptual Site Model / Risk Assessment				
Source / hazard	**Pathway**	**Receptor**	**Assessed Risk level**	**Explanation**
Contaminated soil: on-site and off-site sources	Ingestion/ contact	End user and construction workers	**LOW**	• Desk study indicates predominantly residential usage of the site and adjacent area since at least middle/late 19th century; thus likelihood of off-site contamination migrating onto the site is considered low • No sources of on-site contamination identified • Only elevated Lead values measured in the soil samples tested for residential end use • Whole site to be buildings and hardcover • Workers to observe normal hygiene precautions when handling soils; any soil suspected of being contaminated should be set aside under cover and specialist advice sought
Contaminated soil: on-site and off-site sources	Migration of contaminated groundwater and/or surface run-off through contaminated fill into aquifer or surface water	Aquifer or surface water	**LOW**	• The site is underlain by an 'unproductive' aquifer • The site is within a Source Protection Zone 2 but there are no water abstraction points nearby • There are no sensitive land uses, petrol filling stations, landfill sites or pollution incidents within 250m of the site • There are no nearby surface water features • The main chalk aquifer will be present at depth and will be protected by a significant thickness of very low permeability clay [London Clay and Lambeth Group clay]
Contaminated soil	Disposal in landfill	Waste disposal	**LOW**	• Elevated Lead values were measured in the soil samples tested for residential end use • WAC testing has shown that Lead falls within 'Inert' classification • No significant visual/olfactory evidence of contamination was observed in the soils • Waste classification will be required to the satisfaction of the landfill operator prior to disposal
Ground gas: on-site and off-site sources	Migration	End-user and buildings	**LOW**	• No putrescible material observed during the investigation; low hydrocarbon levels recorded • No landfill sites located in the area of the site • No radon protective measures are required based on desk study • Ground gas control measures not required

In conclusion, based upon the information reviewed and the results of the investigation we consider the potential for significant pollution linkages at this site to generally be LOW.

As our investigation was of a limited extent, however, there may be areas within the site where significant contamination is encountered during demolition / construction and a careful watching brief will need to be kept during the construction phase to ensure that any potentially contaminated soil encountered is disposed of in a safe and controlled manner. Site workers should observe normal hygiene precautions when handling soils. If material suspected of being contaminated is identified during construction, this material should be set aside under protective cover and further tests undertaken to verify the nature and levels of contamination present.

APPENDIX A

GROUNDSURE DESK STUDY INFORMATION
6th JUNE 2012

- Ordnance Survey/ National Grid maps – large scale
  Ref. SCL-361222
- Ordnance Survey/ National Grid maps – small scale
  Ref. SCL-361222
- Groundsure EnviroInsight - database and maps
  Ref. SCL-361223
- Groundsure GeoInsight – database and maps
  Ref. SCL-361224

Soil Consultants Ltd

Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: National Grid

Map date: **2012**

Scale: 1:10,000

Printed at: 1:10,000

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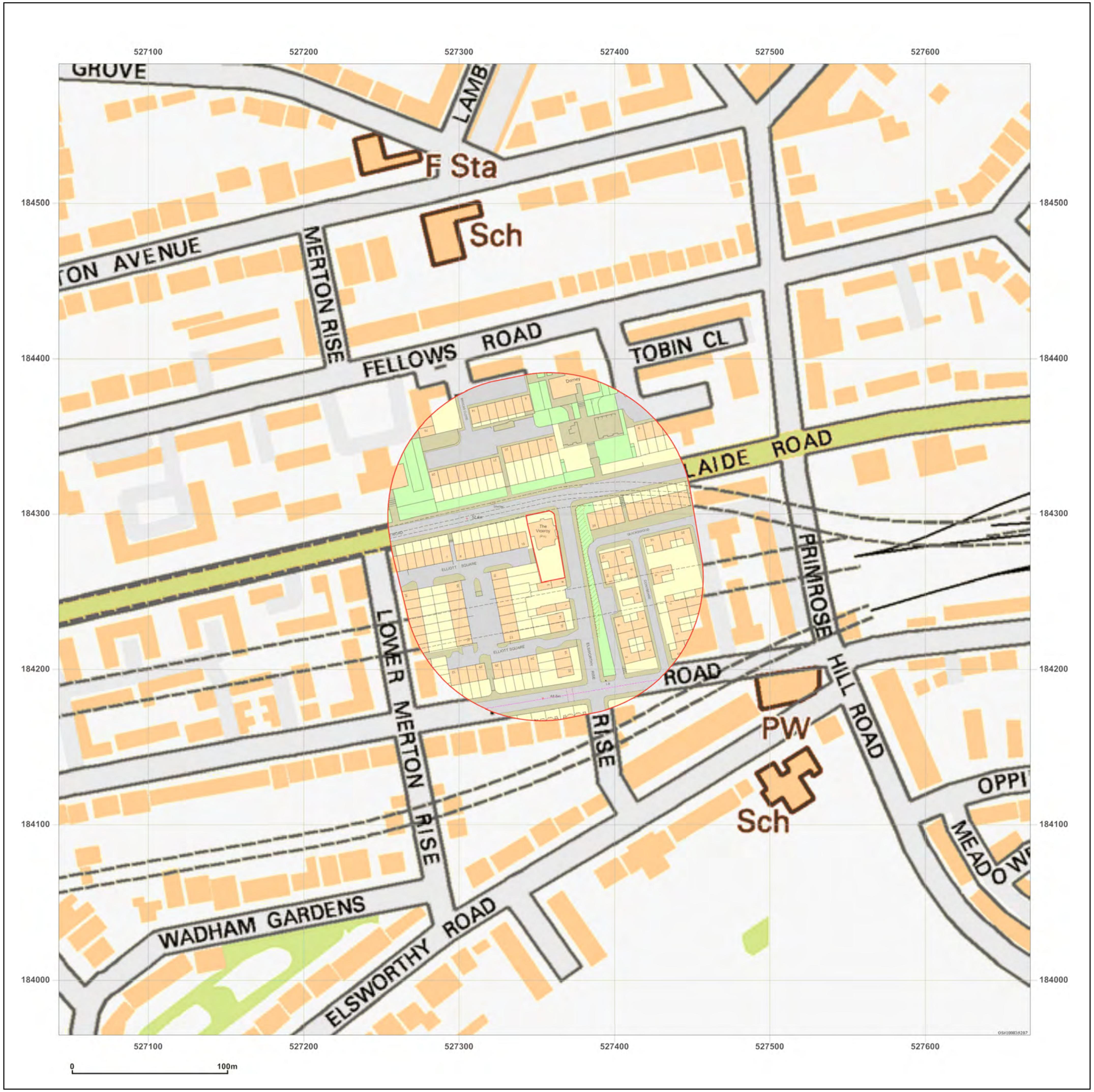
Ordnance Survey
Licensed Partner

Produced by
GroundSure Environmental Insight
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 06 June 2012

To view map legend click here *Legend*



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Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: MasterMap

Map date: **2012**

Scale: 1:1,250

Printed at: 1:2,500

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2012

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Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: 1:10,000 Raster

Map date: 2002

Scale: 1:10,000

Printed at: 1:10,000

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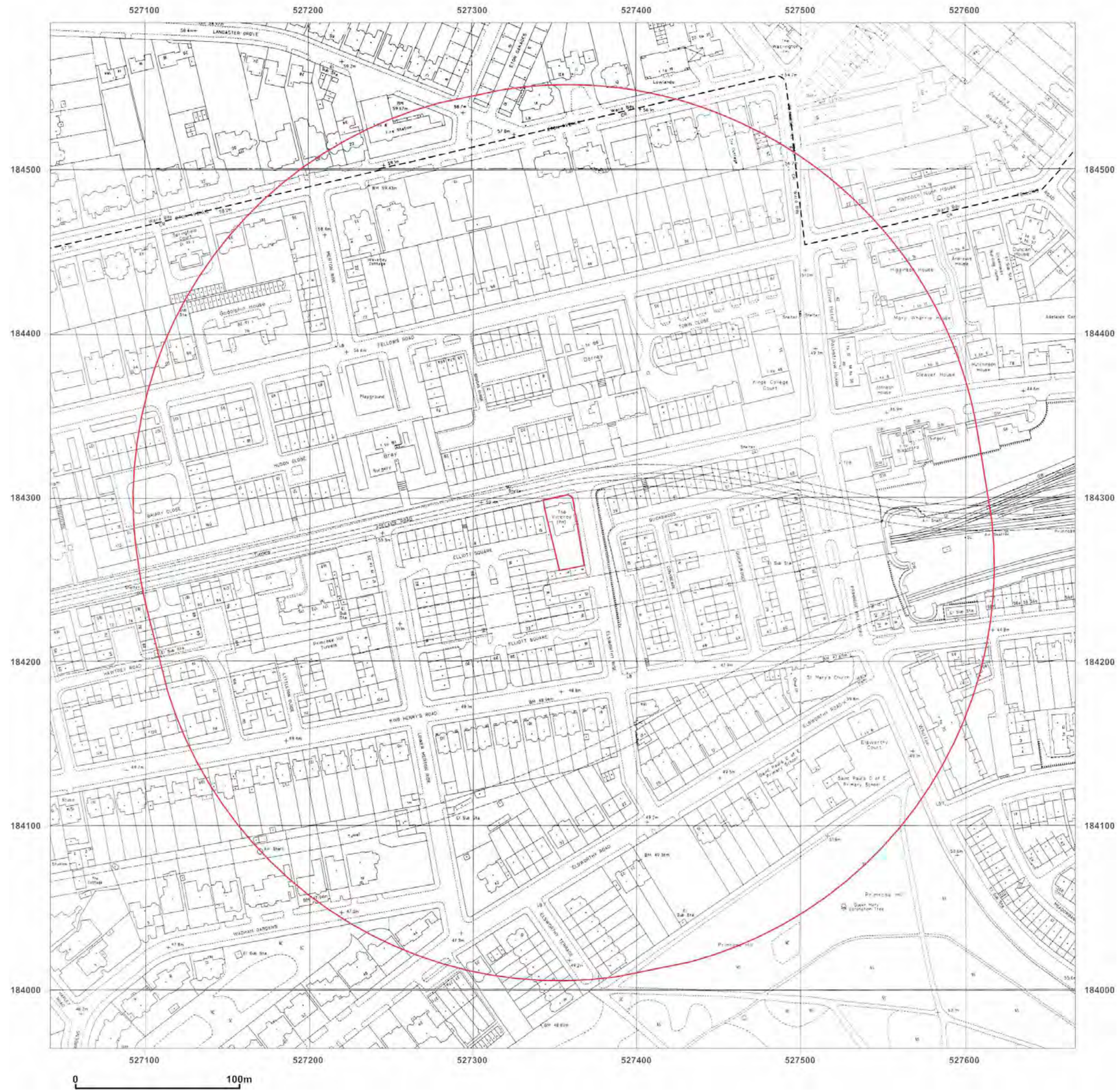
Production date: 06 June 2012

To view map legend click here *Legend*



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Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: National Grid

Map date: **1991**

Scale: 1:1,250

Printed at: 1:2,500

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Surveyed 1991 Revised 1991 Edition N/A Copyright 1991 Levelled N/A	Surveyed 1991 Revised 1991 Edition N/A Copyright 1991 Levelled N/A
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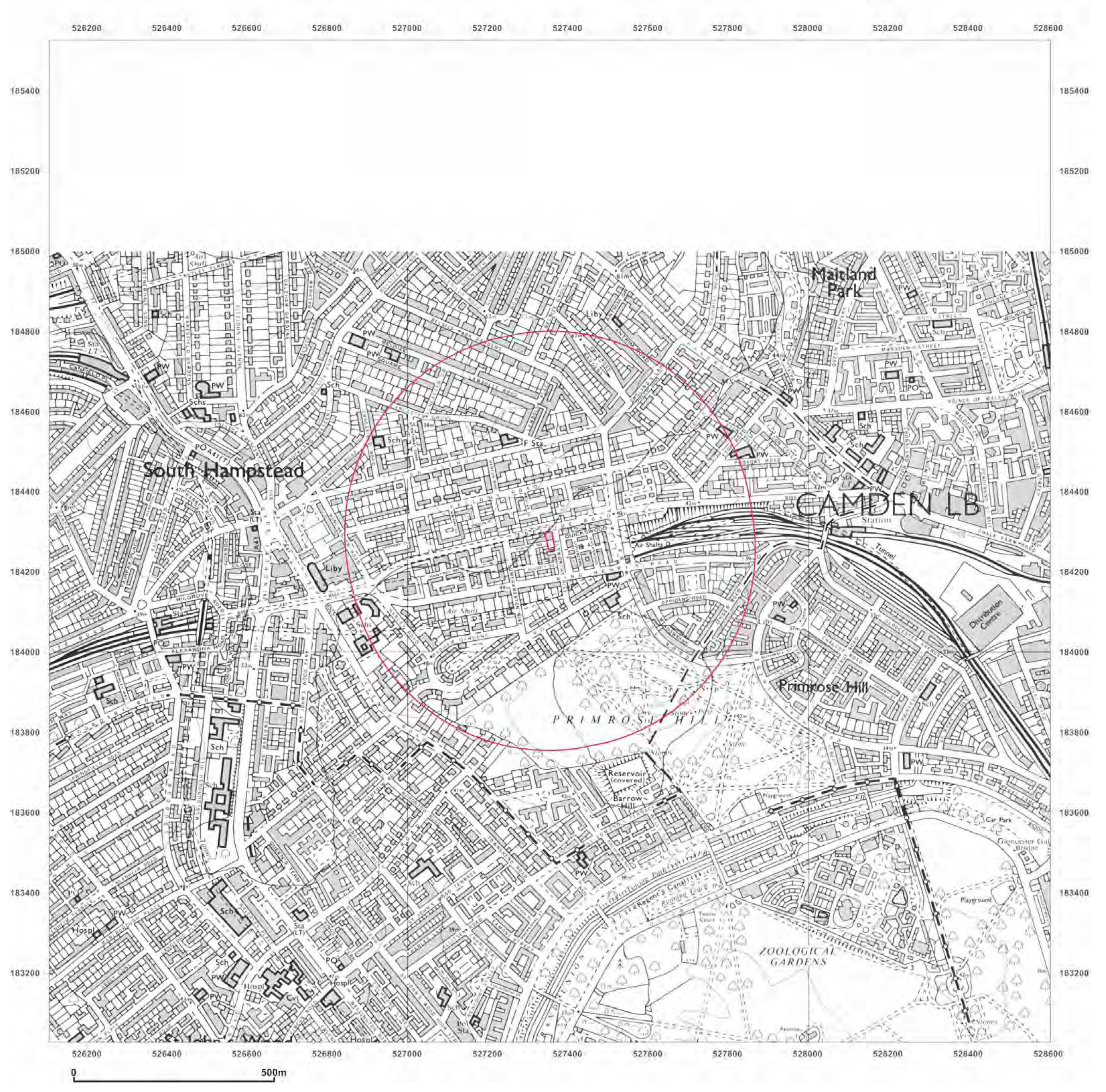
To view map legend click here *Legend*



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Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: National Grid

Map date: **1989**

Scale: 1:10,000

Printed at: 1:10,000

N W E S

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Revised 1989
Edition N/A
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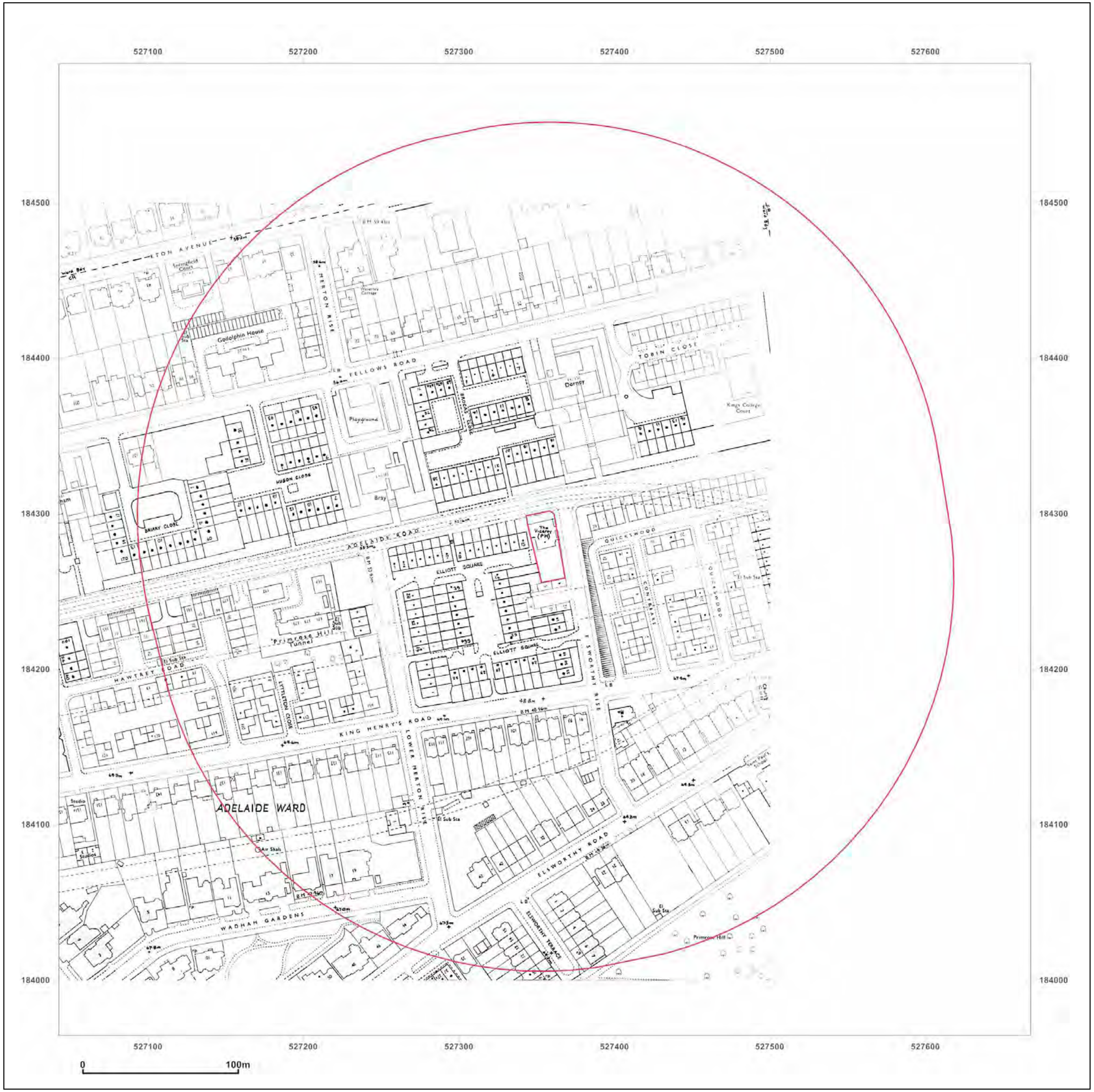
Production date: 06 June 2012

To view map legend click here *Legend*



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Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: National Grid

Map date: **1985**

Scale: 1:1,250

Printed at: 1:2,500

N W E S

Surveyed N/A
Revised N/A
Edition N/A
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Levelled 1975

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W: www.groundsure.com

Production date: 06 June 2012

To view map legend click here *Legend*

Soil Consultants Ltd

Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: National Grid

Map date: **1983-1987**

Scale: 1:1,250

Printed at: 1:2,500

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Surveyed 1987 Revised 1987 Edition N/A Copyright N/A Levelled N/A	Surveyed N/A Revised N/A Edition N/A Copyright 1983 Levelled 1975

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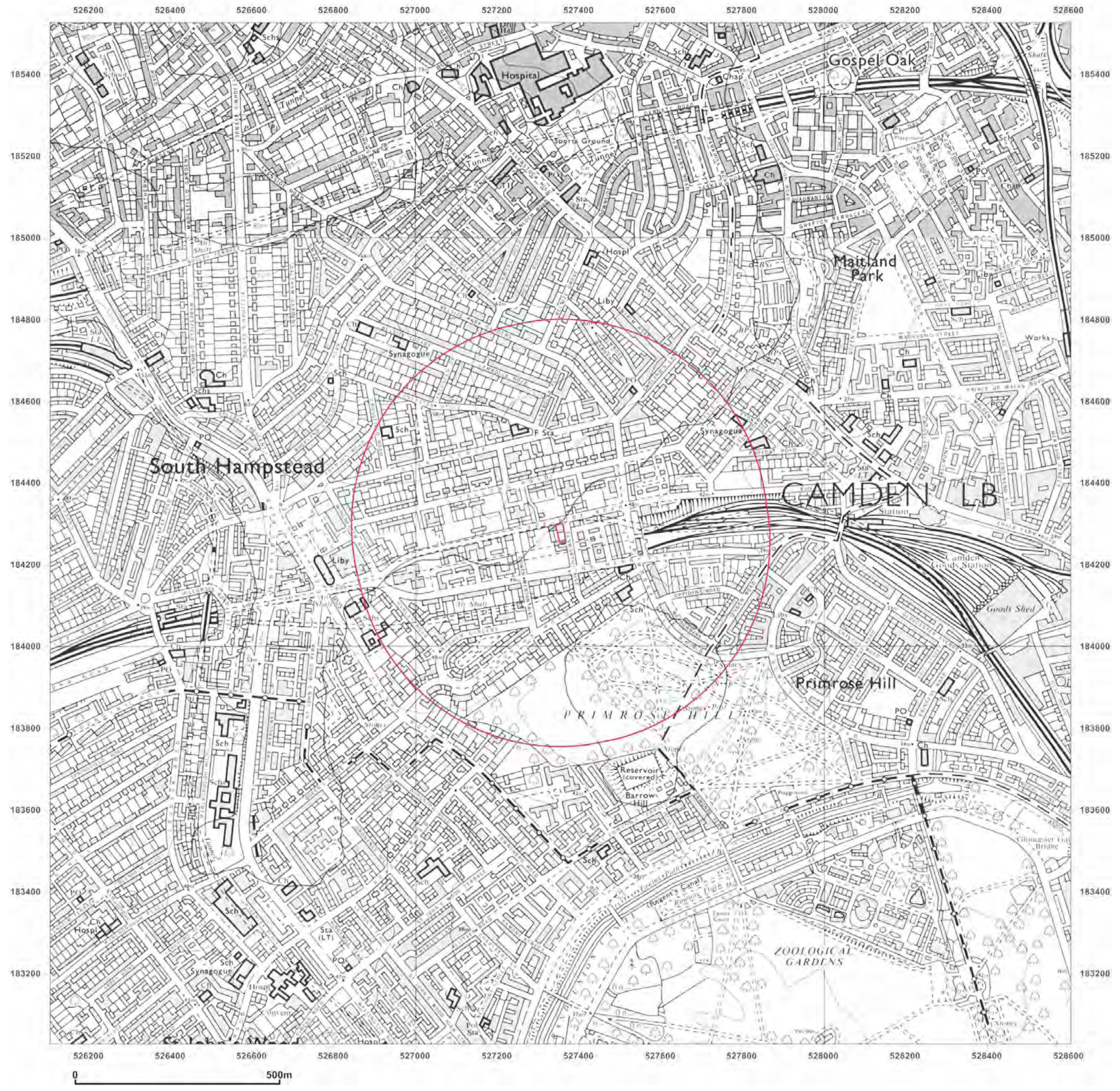
To view map legend click here *Legend*



Soil Consultants Ltd

Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: National Grid

Map date: **1973-1974**

Scale: 1:10,000

Printed at: 1:10,000

N
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Surveyed 1974
Revised 1974
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1972
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

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Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: National Grid

Map date: **1969-1973**

Scale: 1:1,250

Printed at: 1:2,500

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Surveyed 1953 Revised 1968 Edition N/A Copyright 1969 Levelled 1954	Surveyed 1952 Revised 1973 Edition N/A Copyright 1973 Levelled 1954
Surveyed 1953 Revised 1972 Edition N/A Copyright 1972 Levelled 1954	Surveyed 1952 Revised 1972 Edition N/A Copyright 1972 Levelled 1954
Surveyed 1952 Revised 1970 Edition N/A Copyright 1971 Levelled 1953	Surveyed 1952 Revised 1968 Edition N/A Copyright 1969 Levelled 1953

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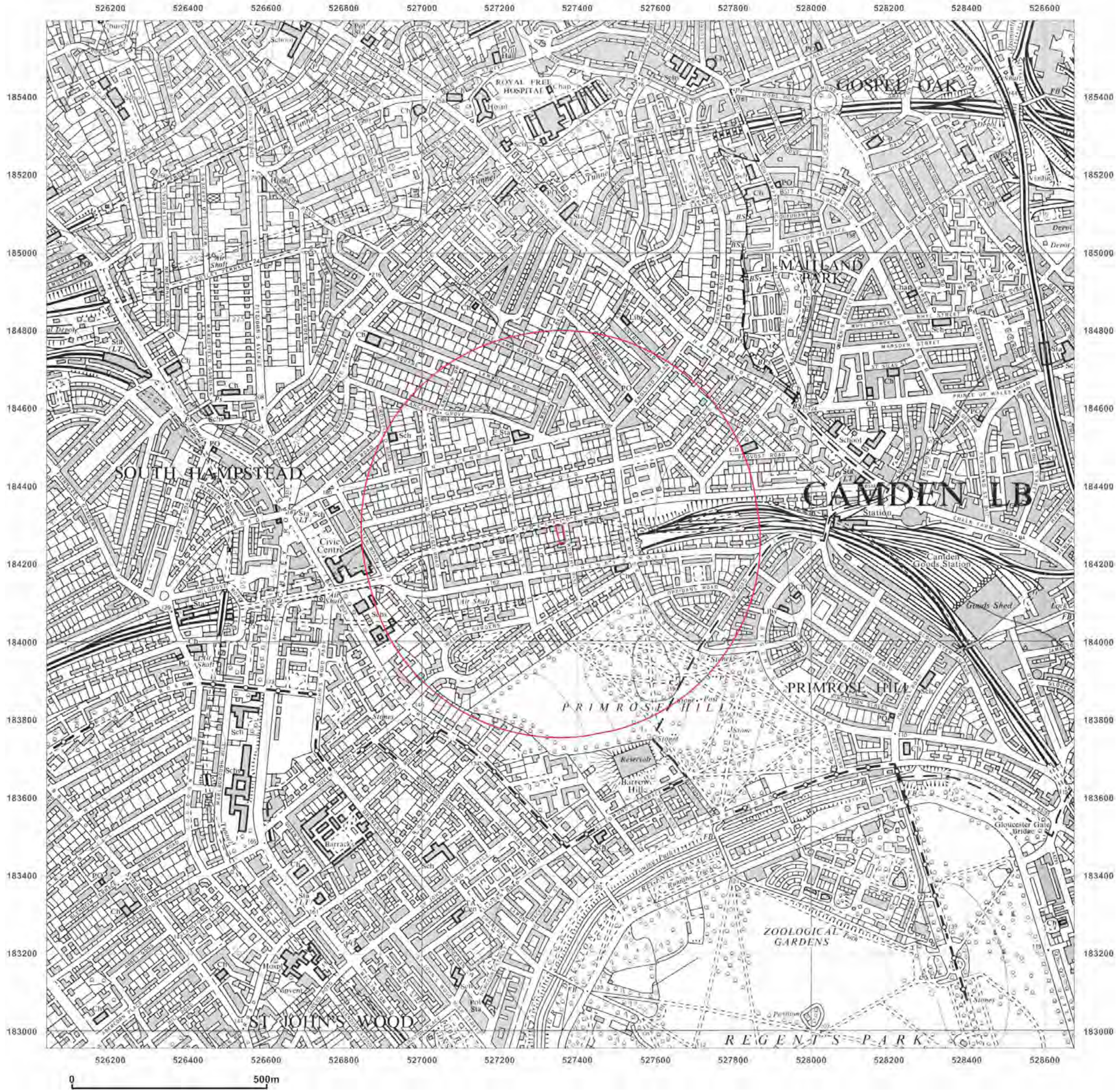

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Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: Provisional

Map date: **1965-1968**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1965
Revised 1965
Edition N/A
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Levelled N/A

Surveyed 1968
Revised 1968
Edition N/A
Copyright N/A
Levelled N/A

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Ground Investigation - Geotechnical Analysis - Contamination Assessment

Site Details:

THE ADELAIDE, 143, ADELAIDE ROAD, LONDON, NW3 3NL

Client Ref: 9206/AW
Report Ref: SCL-361222
Grid Ref: 527355, 184277

Map Name: National Grid

Map date: **1962-1966**

Scale: 1:1,250

Printed at: 1:2,500

N
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Surveyed 1952
Revised 1962
Edition N/A
Copyright 1963
Levelled 1954

Surveyed 1953
Revised 1965
Edition N/A
Copyright 1966
Levelled 1954

Surveyed 1962
Revised 1962
Edition N/A
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Surveyed 1952
Revised 1961
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