BASEMENT IMPACT ASSESSMENT

AT

231 GOLDHURST TERRACE
LONDON

FOR

MR & MRS ZUR-SZPIRO

REPORT REF: ZS 3170Rev 1

Engineering Geologists and Environmental Scientists

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NOVEMBER 2014

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QUALITY MANAGEMENT FOR REPORT

Project	231 Goldhurst Terrace, Swiss Cottage, London, NW6 3EP		
Client	Mr and Mrs Zur-Szpiro		
Date	June 2015		
Version	Issue 2 Rev 1		
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	Chris Tomlin	MEng, CEng, MIStructE	Croft Structural Engineers

Information has been collated for the Report by:

- Rab Resilience and Flood Risk Ltd, Report Reference RAB 942B, 231 Goldhurst Terrace, Flood Risk Assessment, dated October 2014, Vers 2 July 2015.
- Croft Structural Engineers, Report Reference 141002, Basement Structural Method Statement-Structural Calculations and Drawings,October 2014.
- Ashton Bennett Ltd, Report No ZS 3170 Rev 1, Basement Impact Assessment for 231 Goldhurst Terrace, Swiss Cottage, London, NW6 3EP. June 2015.

NON TECHNICAL SUMMARY OF REPORT

HYDROLOGY, HYDROGEOLOGY, GROUND INVESTIGATION

The site has always been occupied by open ground or a residential house and contamination was not detected in soil tests from the ground. The site is underlain by the London Clay which does not generally hold groundwater except in thin lenses of limited extent. Water detected in a groundwater monitoring point indicated leaking drains. Sump pumping may be required for construction during and after heavy rainfall.

The basement construction is unlikely to detrimentally affect the depth or flow of groundwater beneath the site, and is unlikely to affect any water abstraction wells, surface water, ponds or underground rivers. The site lies within 100m of the former River Westbourne which is now culverted in the NW Relief Sewer.

There will be a minor reduction in lawned area increasing rainfall run off slightly which can be mitigated by the use of rainwater harvesting.

The London Clay may shrink and swell or heave on varying moisture conditions and this needs to be taken into account by the use of a void or compressible material beneath the floor slab.

There are no trees to be felled for the development. The basement is likely to increase the depth of foundations compared to neighbouring properties. The site does not lie over any railway tunnels.

FLOOD RISK REPORT

The site lies within Flood Risk Zone 1 with a low flood risk. The site has a low risk of fluvial flooding and a very low risk of surface water and groundwater flooding. The site lies within a Critical Drainage Area of Goldhurst which has a pluvial/sewer capacity issue, although there is no record of no 231 being flooded.

Mitigation measures include tanking the basement, non return valves on drains and use of rainwater harvesting with grey water recycling to cope with additional rainfall run off from new hard cover area.

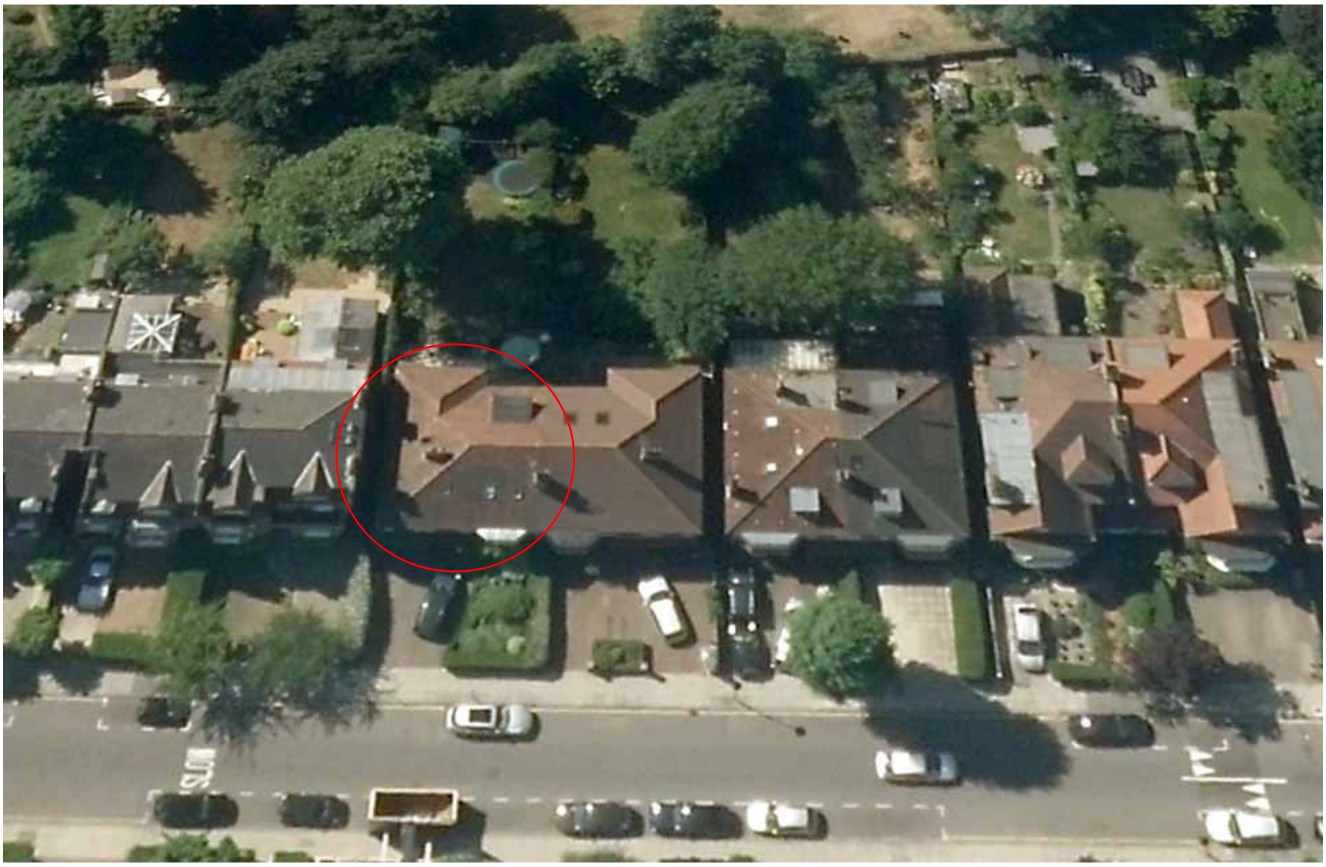
STRUCTURAL REPORT

Reinforced concrete cantilevered retaining walls with underpinned party walls have been designed for construction to minimise risk to adjacent properties. The walls have been designed for a water level 1m from ground level, to take into account uplift and hydrostatic pressure. Calculations and Method Statement are included in the report. Damage to neighbouring properties classifies according to empirical calculations as hairline cracks or Category 0 -1 according to CIRIA 580 recommendations.

EXECUTIVE SUMMARY

Site Location	231 Goldhurst Terrace, London NW6 3EP
Site Description	Semi-Detached 5 storey house
Historical Land Use	Open land and House constructed by 1935.
Current Land Use	Residential house
Potential Contamination	Low Risk
Archaeological Potential	Low Risk
Hydrogeology	Non productive Aquifer
Hydrology and Flooding	No risk of flooding from seas and rivers
Underground rivers	None that could affect the site or be affected by the basement
Critical Drainage Areas	Within a CDA of West Hampstead LFRA of Goldhurst. Flood Risk Assessment undertaken, Low risk of Flooding identified, mitigating measures of rainwater harvesting.
Flooding from Surface Water	Low Risk
Flooding Incidents	Recorded in east end of Goldhurst Terrace only
Flooding from Sewers	Low Risk
Flooding from Reservoirs	Low Risk
Flooding from Groundwater	Low Risk
SUDS	Ground not suitable for soakaways, rainwater harvesting recommended
Geology	London Clay, highly plastic use of material to accommodate heave required
Landfill gas potential	No landfill within 250m, no methane or radon gas protection required
Contamination	Low risk
Geotechnical Properties	Clay strata is highly plastic
Extra hard cover	25-50m2
Groundwater	Borehole dry to 5.45m bgl, no dewatering required, sump pump may be necessary during and after heavy rainfall
Concrete	Underground concrete to be designed as Design Class is DS3 ACEC Class AC-2s.
Ground Movement	Category 0-1 according to Burland and Boscardin and Cording
Waste Disposal	Waste disposal is responsibility of owner to ensure it is disposed appropriately to landfill. Likely to go as inert waste.

![Ashton Bennett]



1. INTRODUCTION

This report describes the results of a Basement Impact Assessment undertaken for the development of a basement at 231 Goldhurst Terrace, Swiss Cottage, London, NW6 3EP. The work was undertaken on behalf of Mr and Mrs Zur-Szpiro and was carried out by the Ashton Bennett Consultancy. Plans of the proposed development are provided in Appendix A.

The purpose of this Report is to ascertain the potential impacts that the proposed basement may have on the ground stability, the hydrogeology and the hydrology in the vicinity of the site. The site lies within the Administrative Boundary of Swiss Cottage within the London Borough of Camden. The assessments were carried out in general accordance with the London Borough of Camden Development Policy 27 “Basements and Lightwells” and Camden Planning Guidance 1 “Design Note prepared by London Borough of Camden for New Basement Development and Extensions to Existing Basement Accommodation” (LBC, 2010).

As stated in Camden Development Policy DP27 paragraph 27.1, LB Camden “will only permit (basement and other underground development that) does not cause harm to the built and natural environment and local amenity and does not result in flooding or ground instability”.

The approach followed in this report was initially to undertake screening of the site and provide a full site characterisation by a desk study of available geological, hydrological, hydrogeological, environmental and historical and topographic information together with a site visit. The results of the screening enabled scoping which determined that a ground investigation was required to establish ground conditions, a Flood Risk Assessment and Structural Method Statement. The Basement Impact Assessment (BIA) is provided in full and is undertaken in general accordance with the recommended methodologies highlighted in Arup document "Guidance for Subterranean Development", prepared for the London Borough of Camden Planning Guidance CPG4 and in URS document "London Borough of Camden SFRA" July 2014.

The five stage approach taken comprises of:

- Screening – Identification of matters of concern using checklists.
- Scoping – Definition of the matters of concern identified in the screening.
- Site Investigation and Study – Establishment of the baseline conditions
- Flood Risk-Baseline Conditions and Recommendations
- Structural Design-Method Statement
- Impact Assessment – Determination of the impact of the proposed basement on the baseline conditions.
- Review and decision making – Undertaken by London Borough of Camden and independent reviewer.

The assessment was prepared by Frances A Bennett an engineering geologist who is a Chartered Geologist CGeol, Chartered Environmentalist CEnv and Chartered Water and Environmental Manager C.WEM at Ashton Bennett Consultancy. The Structural Report was prepared by Chris Tomlin MEng, CEng, MIStrctE of Croft Structural Engineers Ltd and the Flood Risk Assessment was undertaken by Andrew McHugh BSc, MCIWEM of Rab Resilience and Flood Risk as detailed in the Quality Management at the front of this Report.

2. THE SITE

2.1 Site Description

The site is located at number 231 Goldhurst Terrace which lies between the A41 Finchley Road and the A5 Kilburn High Street to the north of the B509 Belsize Road. A site walkover was undertaken on Friday July 11th 2014 in order assess the property and assess the access for drilling rigs.

The site area comprises the house and garden of 231 Goldhurst Terrace which is a private semi detached residence of 0.05 hectares. The house is attached on the west side by house no 233. There is a side entrance along the east side of the house leading to the rear garden.

The site fronts onto Goldhurst Terrace to the north, with a partly grassed and partly hard covered front garden, a hard covered side pathway to the rear and a partly hard covered patio and lawned rear garden.

It is proposed to extend the house to the rear and construct a basement beneath the house and part of the rear garden.

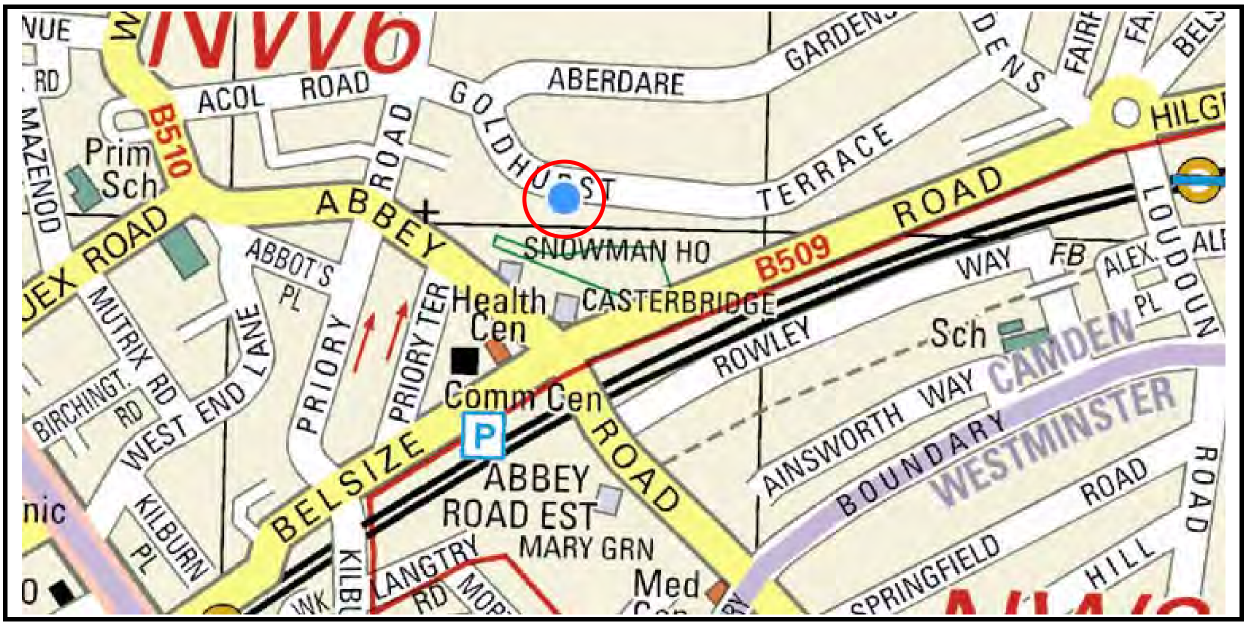


Figure 1 Site Location Plan

The site is bounded to the north by Goldhurst Terrace, to the south by the grassland of the tower blocks fronting onto Abbey Road, to the east by number 229 and to the west by number 233 to which it is attached. The rear garden lies to the south of the house.

All land on the site was relatively flat. The ground level in the rear garden is at a slightly lower elevation than the front garden and is unlikely to cause any landslip.

Roof drainage from the existing property is taken via down pipes into a drainage system in the front of the property which is understood to run west to east collecting drainage from the adjoining properties.

There are existing lawn areas to the front and rear of the house which allow infiltration of rainwater into the ground.

A check was made of the bomb locations in Goldhurst Terrace and the nearest to the property was a distance to the east and therefore there is unlikely to be unexploded Ordnance beneath the house.

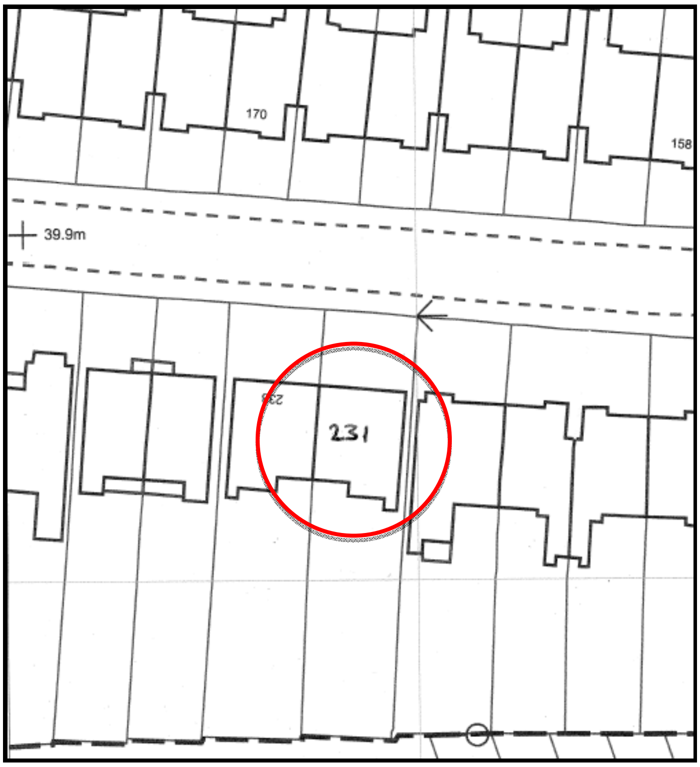


Figure 2A Site Plan

Figure 2B Existing Rear Elevation Photo

Figure 3 Existing Rear Elevation

Figure 4 Proposed Rear Elevation

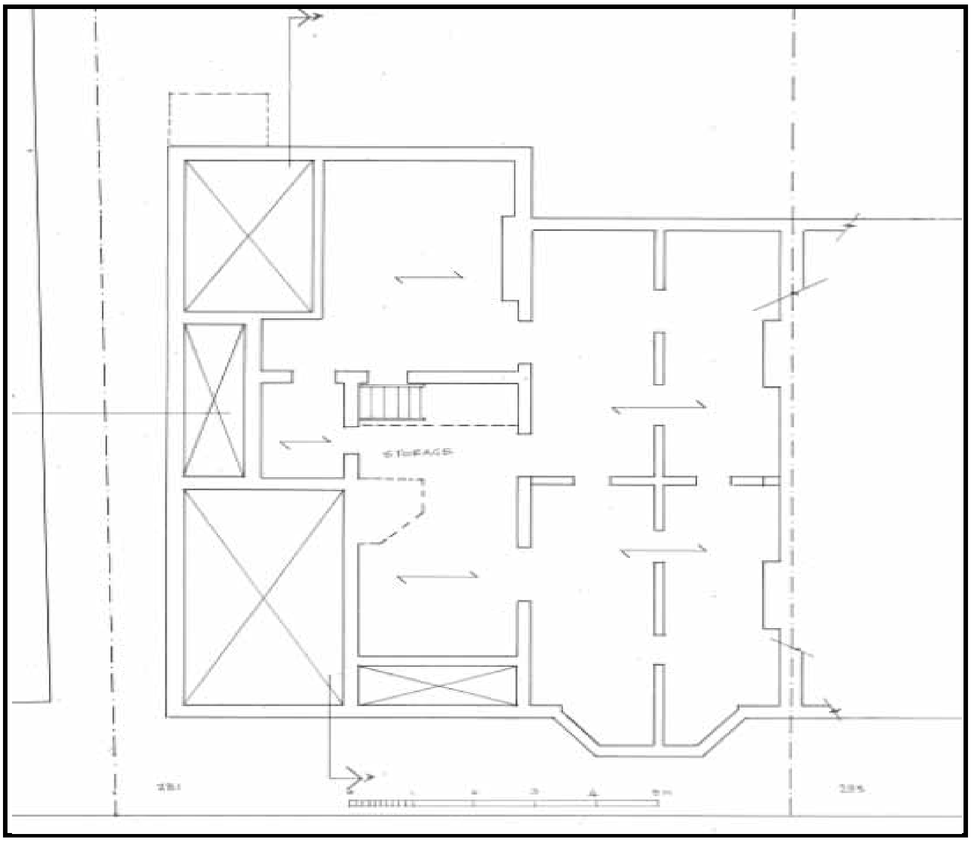


Figure 5a Existing Basement

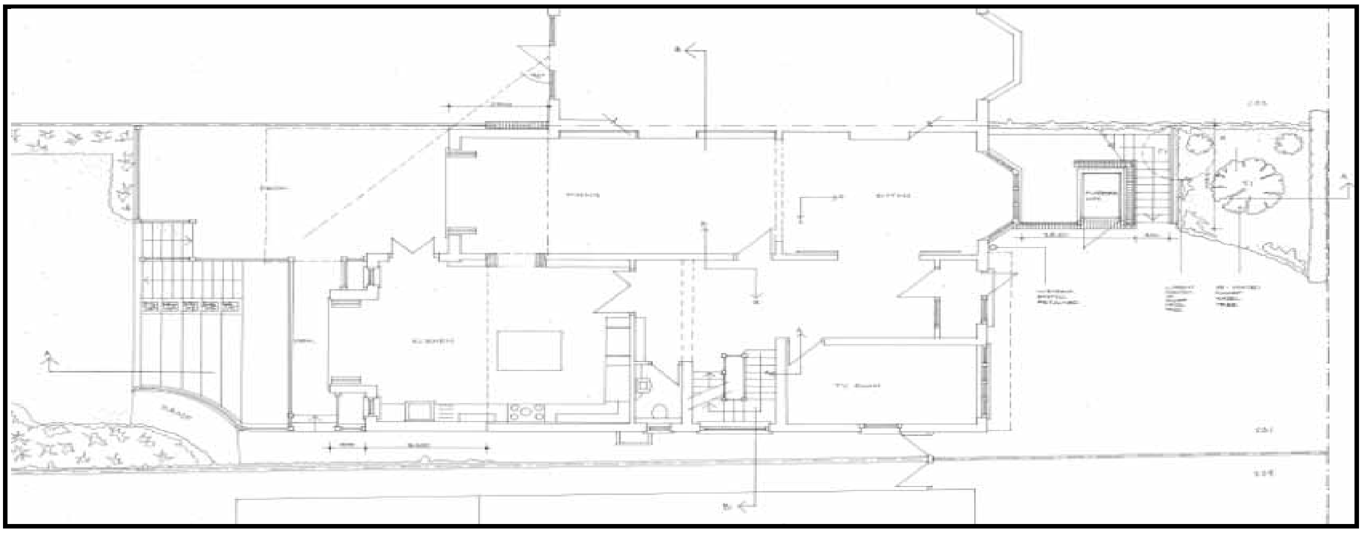


Figure 5b Proposed Basement

The site lies around National Grid Reference 525893^E 184006^N at a height of around 30m above Ordnance Datum. A Site Location Plan is presented as Figure 1 and a Site Plan is presented as Figure 2A and an Existing Rear Elevation Photo as Figure 2B. The Existing Rear Elevation is presented as Figure 3 and the Proposed Rear Elevation as Figure 4. The Existing and Proposed Basement Plans are presented in Figures 5a and 5b.

A Geology Plan is presented as Figure 6, and a Landslip Plan as Figure 7. A Local Borehole Plan is presented as Figure 8. A Hydrogeology Plan is presented as Figure 9. Risk of Flooding from Surface Water is presented as Figures 10a (EA) and 10b (URS) and Figure 11 and Flooded Roads 1975 and 2002 as Figure 12a. The NW Storm Relief Sewer Location is presented as Figure 12b and the 1 in 1000 Year Flood Event as Figure 13 and the EA Flood Risk from Reservoirs as Figure 14. The Risk of Flooding from Groundwater is presented as Figure 15a and Flooding for a 1 in 1000 event as 15b and the Risk of Sewer Flooding (URS2014) as Figure 16. Critical Drainage Areas and Local Flood Risk Zones are presented on Figure 17 and The EA Recorded Landfill Sites within 250m is presented as Figure 18. Transport Infrastructure is presented as Figure 19 and Borehole Location Plan as Figure 20.

Drawings of site proposals are presented in Appendix A and archival maps are presented in Appendix B. Borehole Logs and Geotechnical Test Results are presented in Appendix C. The Flood Risk Assessment is presented in Appendix D and the Structural Engineering Report is presented in Appendix E.

3. SITE HISTORY

The following maps and plans were inspected to assess the history of the site and its past environments. The archival Ordnance Survey maps are presented in Appendix B.

TABLE 1
Historical Maps Inspected

DATE	SCALE	DESCRIPTION	
		SITE	SURROUNDING AREA
1868-71	1:1,056 & 1:2500	The site is undeveloped open fields	There are houses with garden along Belsize to the south of the site.
1873	1:10,560	No significant change.	No change to the surrounding area.
1893	1:2,500	The road outline for Goldhurst Terrace is marked out, but the site is undeveloped	No change to the surrounding area.
1894	1:10,560	No significant change.	Houses to the east of the site Goldhurst Terrace have been built. .
1896	1:2,500	No significant change.	No change to the surrounding area.
1915	1:2,500	Goldhurst Terrace and the houses thereon have been built with the exception of the site and that of the three properties adjacent and to the west	The surrounding area has been developed.

DATE	SCALE	DESCRIPTION	
		SITE	SURROUNDING AREA
1920	1:10,560	No significant change.	No change to the surrounding area.
1935	1:2,500	The house, 231 has now been built	The three properties to the west have been built
1948-51	1:10,560	No significant change.	No change to the surrounding area.
1957-8	1:10,560	No significant change.	No change to the surrounding area.
1965-8	1:10,560	No significant change.	The houses to the south fronting onto Belsize and Abbey Road have been demolished
1969	1:2,500	No significant change.	The two tower blocks to the south of the property have been built
1973-6	1:10,000	No significant change.	No significant change.
1989-93	1:10,000	No significant change.	No significant change.
2002	1:10,000	No significant change.	No significant change
2012	1:10,000 & 1:1,250	No significant change.	No significant change to the surrounding area.

In summary, the site was open fields until 1893, when Goldhurst Terrace road was formed, most of the houses in Goldhurst Terrace were built between 1893 and 1920, but this house, No 231 and the three properties to the west were constructed later – before 1935.

4. POTENTIAL CONTAMINATION & ARCHAEOLOGY

With the exception of made ground that may have been associated with the past residential development on the site and in the surrounding area, the historical map search has not identified any potential sources of contamination or archaeological features that could be present on the site.

A search of environmental databases via an EnviroInsight report (provided by Centremaps) did not reveal any offsite sources of contamination that are considered likely to pose a risk to the site and the proposed development. It was not considered necessary to undertake tests for contamination.

5. SITE GEOLOGY

5.1 Geology

The published 1:50,000 scale British Geological Survey (BGS) geological map of the area (Sheet 256 "North London") shows the site to be underlain by the London Clay Formation (up to 85m thick) of the Eocene geological epoch. The London Clay is underlain by further clays, sands and chalk. An extract of the BGS Geological Map is provided in Figure 6 below.

The London Clay is shown not to be overlain by any superficial deposits. Given the historical development of the site and surrounding areas, there may be made ground present on the site.

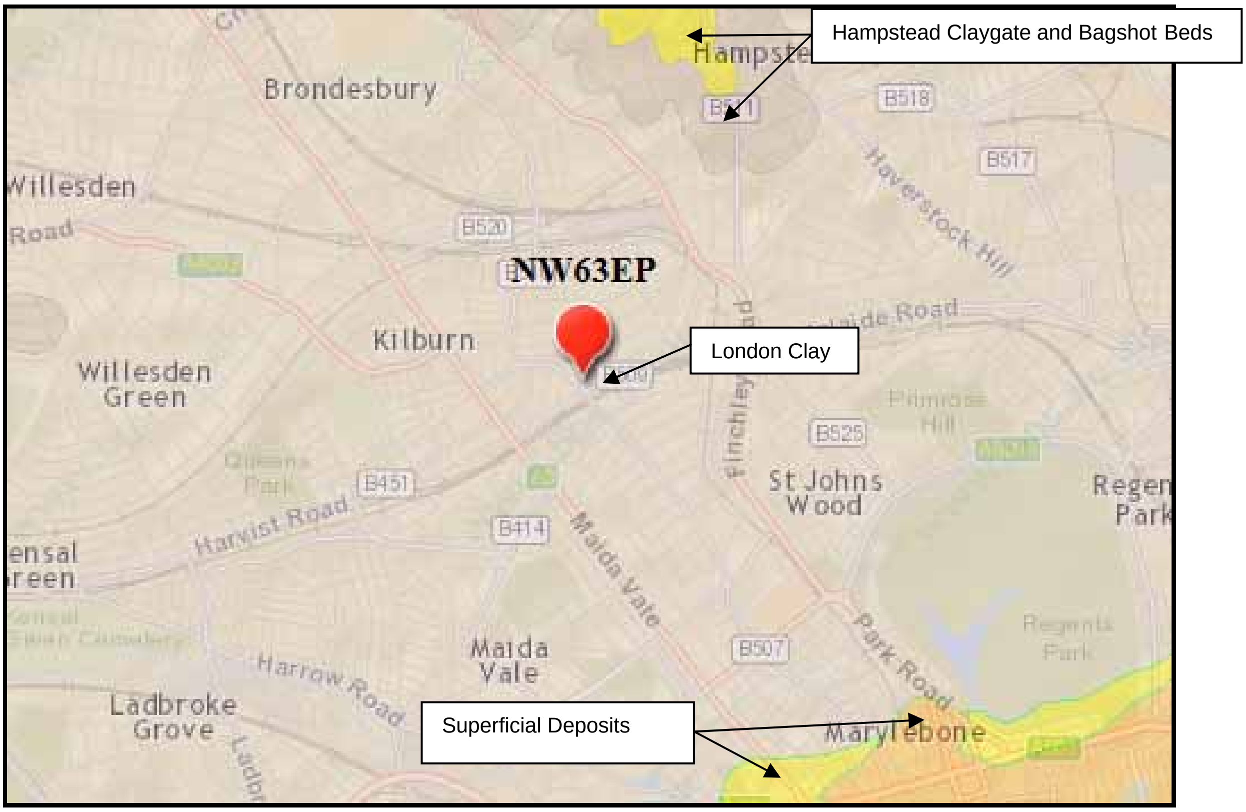


Figure 6 Geological Plan

No geological faults are shown to be present within close proximity to the site.

5.2 Mining

There is no evidence of past or present mining or quarrying activity in the vicinity of the site. The site does not lie in a mining area for coal, tin, gypsum, stone or other recorded mineral works.

5.3 Landslips

The site is shown not to be within an area of significant landslide potential as shown in Figure 7 Landslip Plan. (reference Figure 17 of Arup Report for London Borough of Camden "Guidance for Subterranean Development", 2010). This is reinforced by the low slope angles recorded during the site walk over and the geology of the London Clay with no overlying deposits.

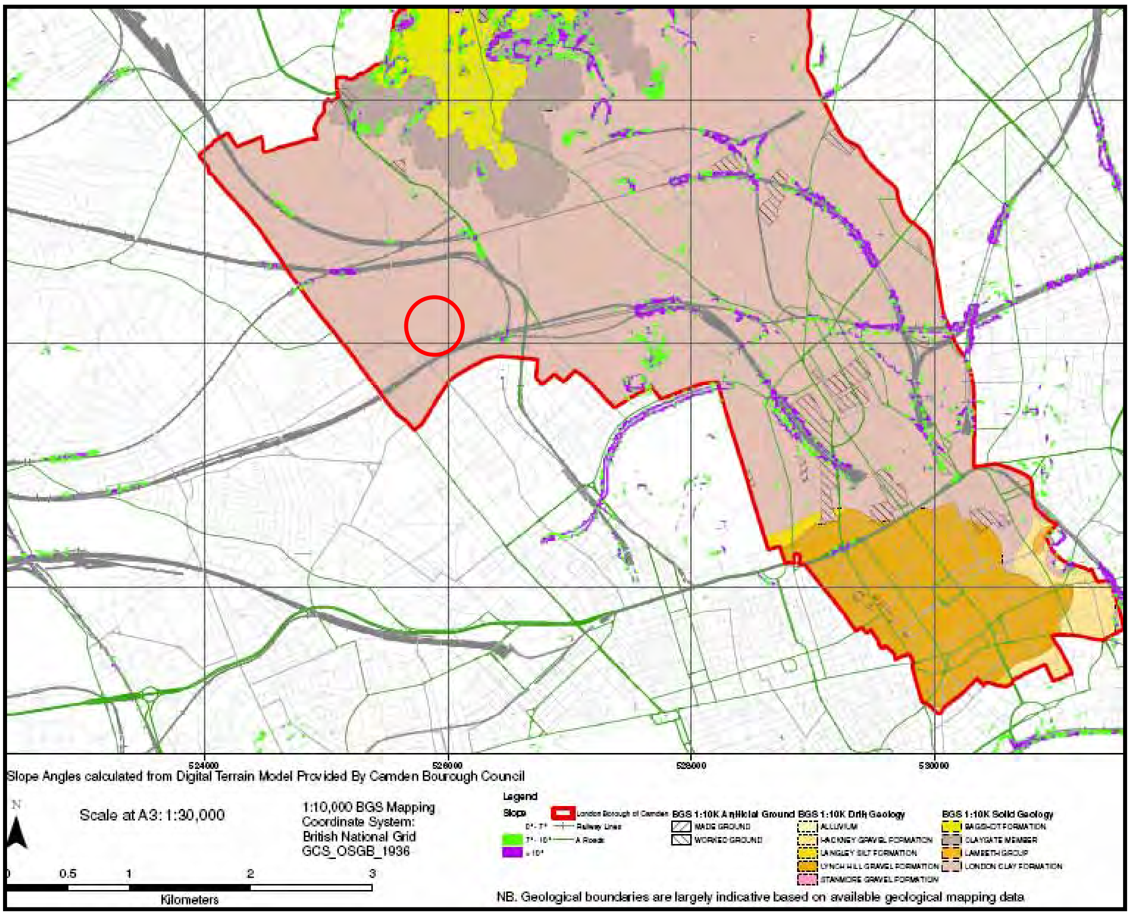


Figure 7 Landslip Plan

5.4 Local Boreholes

A number of relevant available historic borehole logs have been obtained from the BGS website and are summarised in Table 2 below. A plan showing the available local borehole locations is presented in Figure 8.

TABLE 2
Summary of Historical Borehole Logs

BGS Reference	Depth bgl in m	Brief Summary of Ground Conditions	Water Supply
TQ28SW11	85	London Clay to 85m sand thereafter	RWL 40m
TQ28SE360	45.72	London Clay	
TQ28SE46	177	London Clay to 81m, sand to 96 and Chalk thereafter	Water details not recorded

These boreholes confirm the geology of the area surrounding the site and confirm that any local water abstraction wells are from generally >100m depth into the Chalk aquifer.

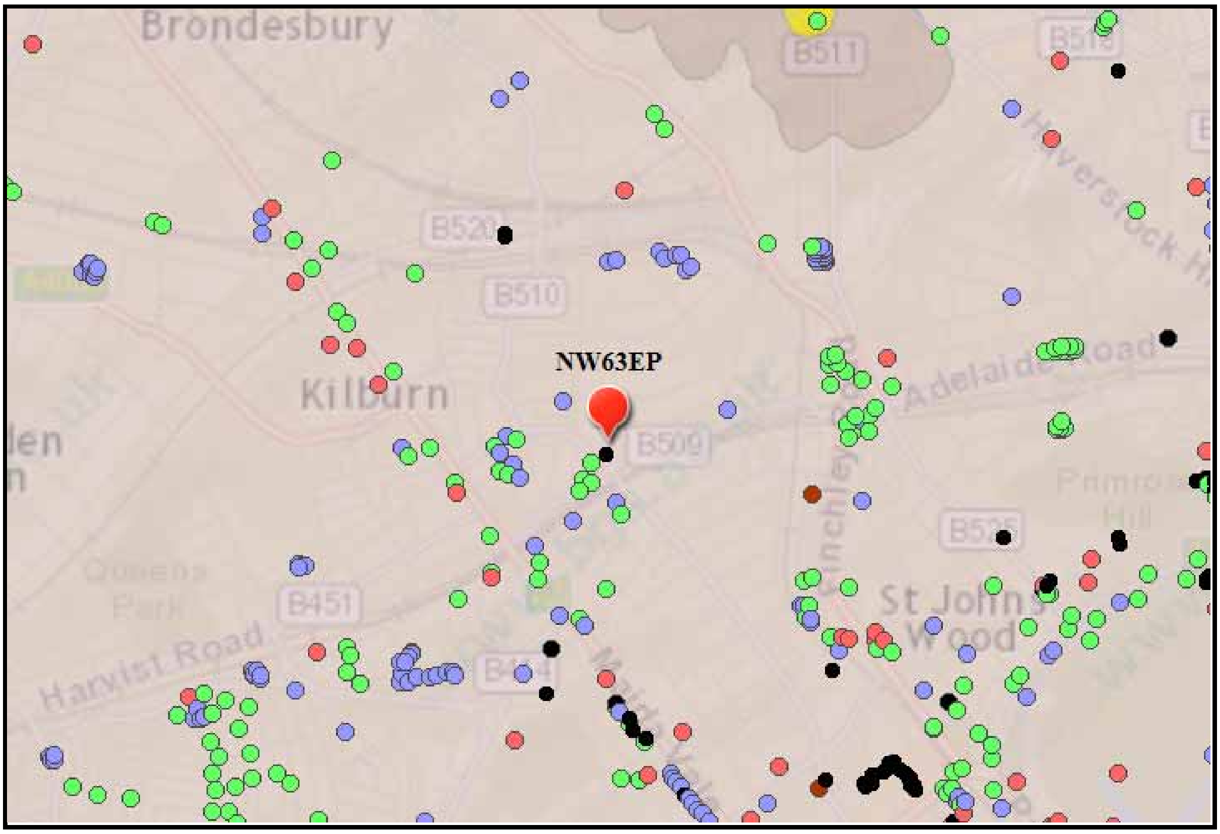
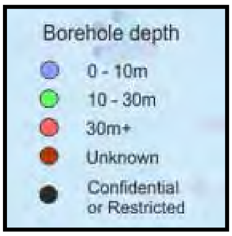


Figure 8 Local Borehole Plan



6. HYDROGEOLOGY

6.1 Aquifers

The above referenced geological map indicates the site to be underlain by the London Clay Formation, which is relatively impermeable. The Environment Agency have designated the London Clay Formation beneath the site as an "Unproductive Aquifer" which means the strata has a low permeability and negligible significance to water supply or base flow to rivers. Permeability of the London Clay varies from 5 $x10^{-6}$ to 1 $x10^{-10}$m/sec.(BS 8004, 1986). The site does not lie on a Groundwater Vulnerability Zone.

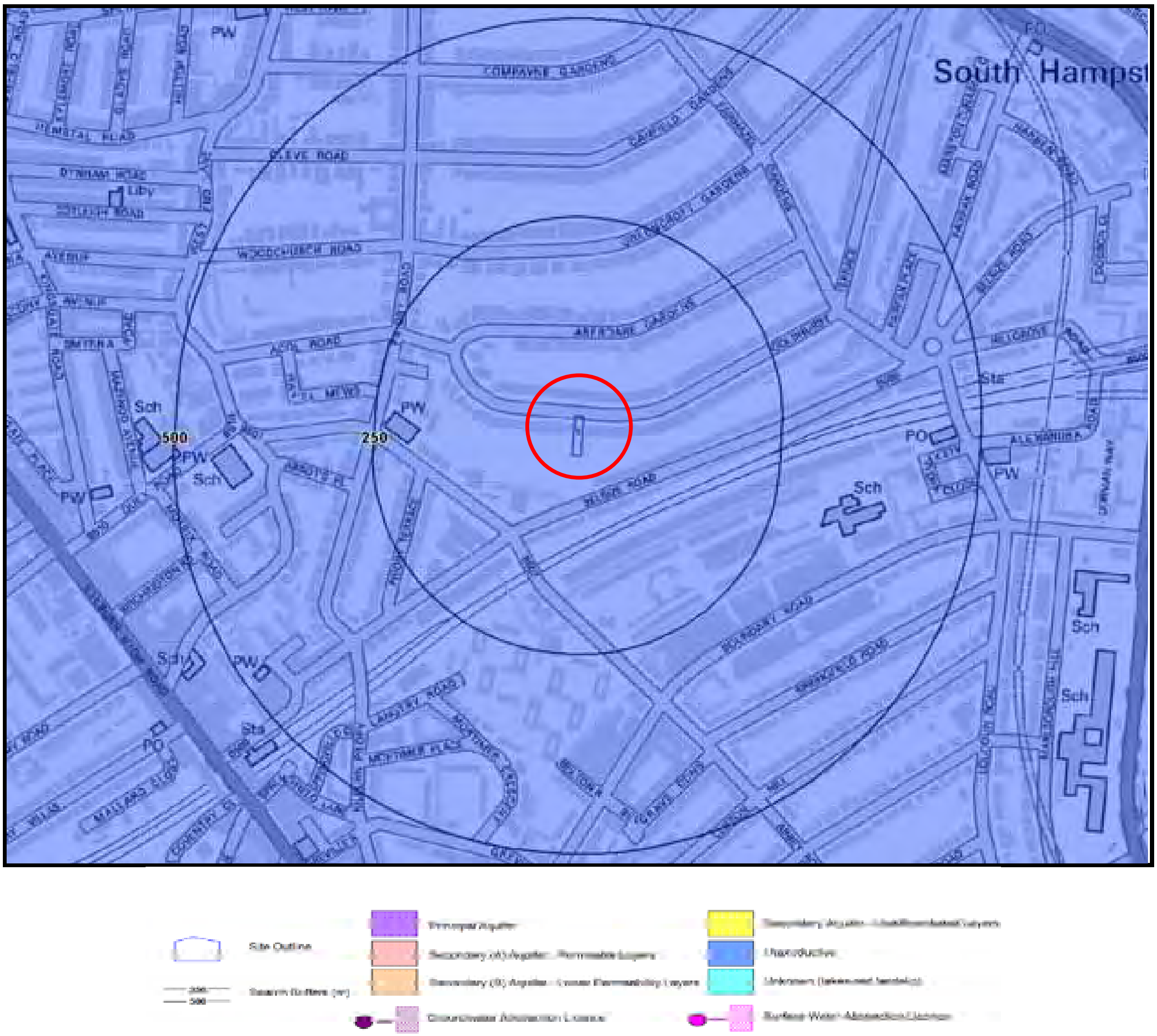


Figure 9 Hydrogeology Plan

The natural soils underlying the site are likely to comprise a superficial covering of made ground (potentially absent) overlying weathered London Clay (clay soils). The London Clay soils have very low permeability and do not readily permit the downwards transfer of surface water or percolating groundwater.

6.2 Groundwater Depth and Flow

The development of a basement is unlikely to detrimentally affect any groundwater which lies circa 100m bgl in the Chalk Aquifer. There are no Superficial Deposits overlying the London Clay which could hold perched water.

A monitoring point installed in a borehole sunk in the rear garden during the ground investigation encountered foul water and no further monitoring has been undertaken. Due to the presence of silt and gravel within the London Clay it is possible that slow seepage of groundwater may occur into any excavations. It is likely that this will be dealt with by sump pumping. It is unlikely that the basement will realign or detrimentally affect any flow of groundwater such that groundwater could detrimentally affect neighbouring properties, springs or watercourses.

It would be prudent to waterproof the basement and take into consideration potential uplift pressures and a groundwater level at least 1m above formation level in case of water rising during and after heavy rainfall.

6.3 Wells and Springs

There are no groundwater or potable water abstraction licences within 500m of the site. There are water abstractions 881m and 934E for spray irrigation and at 1762m E for potable water from Barrow Hill Pumping Station. The site does not lie within a Source Protection Zone for a potable water supply.

Other unrecorded or unlicensed wells may be present close to the site, however abstractions are unlikely to be from the London Clay Formation and likely to be from the underlying Chalk Formation at circa >100m bgl. The development is unlikely to detrimentally affect any water abstractions.

6.4 Flood Risk from Groundwater

According to the BGS there are no groundwater flood susceptibility flood areas within 50m of the site. There is according to the BGS a negligible risk of groundwater flooding based on the underlying geology. This is confirmed in Figure 15a.

6.5 Summary

Based on the ground and groundwater conditions encountered it is considered that the development proposals are unlikely to pose a risk to groundwater levels or groundwater flow or to wells or springs. It is unlikely that the basement will be detrimentally affected by the local hydrogeology provided sump pumping is available during construction, the basement is waterproofed (Grade 3 BS 8102) and uplift pressures from rising groundwater of at least 1m are taken into consideration.

7. HYDROLOGY AND FLOOD RISK

7.1 Hydrology

Prior to the commencement of the redevelopment of the site, the rainfall over the area of the site drains in one of the following ways:

- Surface water from the rear roof drains into the drainage system via underground pipes leading to the front of the site.
- Surface water from the front roof drains into the drainage system that runs under the front area and to the north east of the site.
- Surface water from the rear yard drains into surface drains.

On completion of redevelopment the rainfall will drain in the same manner to public sewers.

There are no surface water features within 250m of the site.

There are no biological river quality assessments within 1.5km of the site. There are no surface water abstraction licences within 1.5km of the site. The closest is 1909m E from Regents Canal for non evaporative cooling.

7.2. Flood Risk From Surface Water

The site is shown by the Environment Agency to lie within a low risk for flooding from rivers and very low from the sea.

Camden is primarily at risk from surface water runoff (i.e. rainwater that is on the surface of the ground and has not entered a watercourse, drainage system or public sewer), groundwater or flooding from sewers which have either burst or gone beyond capacity due to heavy rainfall. All of these situations are only likely to occur in extreme rainfall events such as in 1975 and 2002.

The site lies within the Critical Drainage Area of West Hampstead and the Local Flood Risk Zone of Goldhurst and a Flood Risk was therefore carried out and is presented in Appendix D.

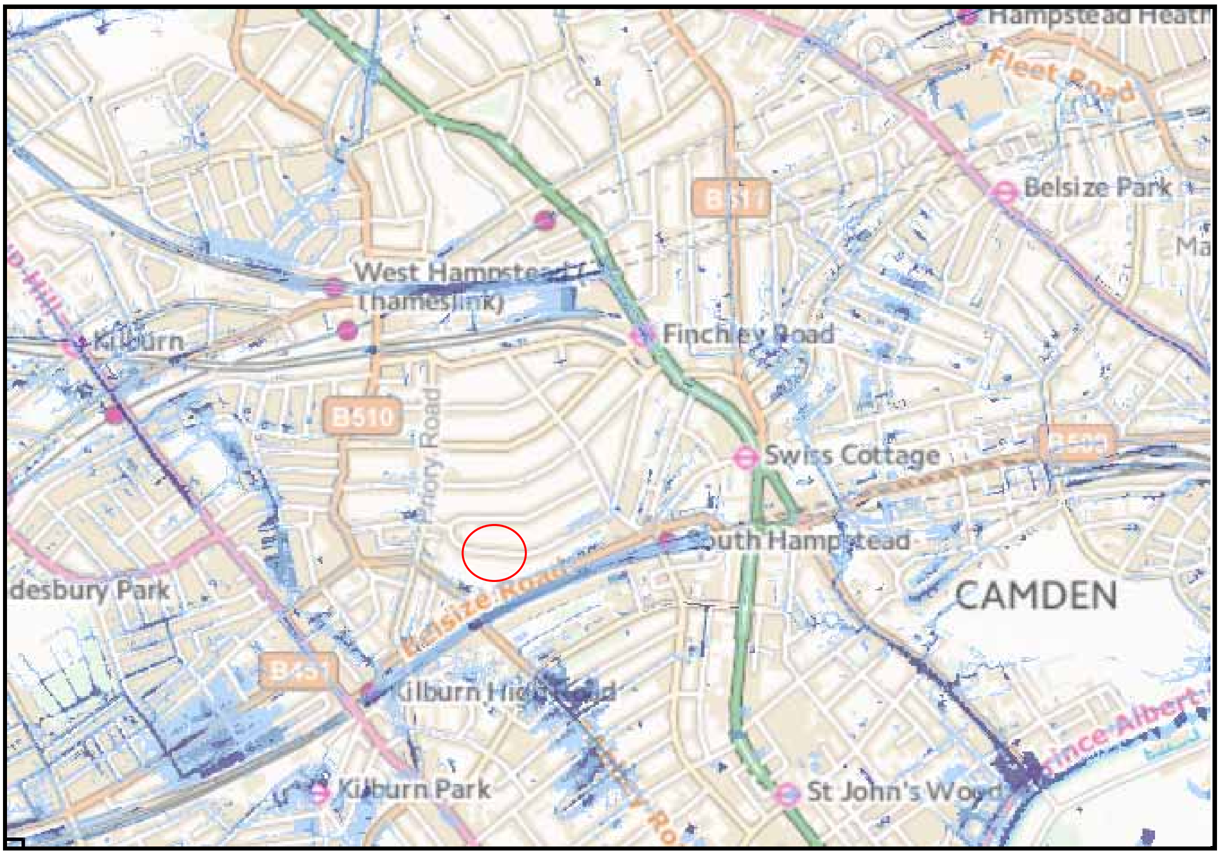


Figure 10a Risk of Flooding from Surface Water (EA 2014)

The history of flooding in this area is that Goldhurst Terrace was affected by flooding in both 1975 and 2002. However after the 2002 floods, Thames Water invested in significant new flood risk infrastructure as part of the West Hampstead Flood Relief Scheme. The project involved larger diameter sewers and a holding tank both of which have substantially reduced flood risk in the area.

The recent Environment Agency map reproduced in Figure 10a indicates a very low risk from flooding from surface water.

The map reproduced from URS 2014 Report indicates 2 properties in Goldhurst Terrace have flooded from surface water. Section 3.2.11 in URS 2014 Report states, " Where streets are shown (on Fig 10b) to have experienced flooding during the 1975 and 2002 flood events, the mapping is relatively coarse in scale and does not allow a distinction between, for example, an entire street flooding, or an isolated section of road flooding as a result of a blocked gulley."

It appears therefore that the EA 2014 map in Fig 10a is more accurate and shows the flooding in the east end of Goldhurst Terrace and away from No 231.

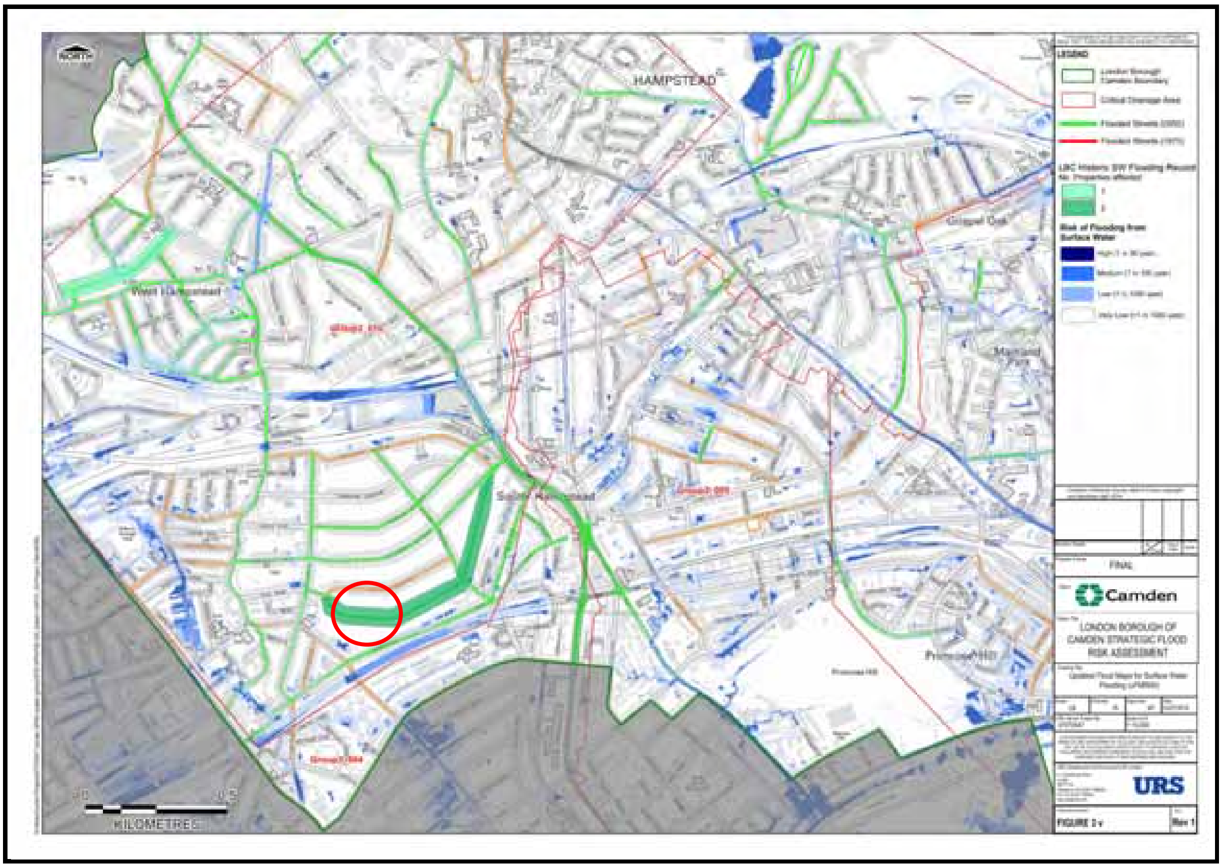


Figure 10b Risk of Flooding from Surface Water (URS 2014)

Figure 10b indicates that two properties only in Goldhurst Terrace have been affected by surface water flooding and the risk of number 231 being flooded is very low according to the EA.

Figure 11 Detailed Surface Water Flood Risk

The Detailed Surface Water Flood Risk also shows flooding at the east rather than west end of Goldhurst Terrace.

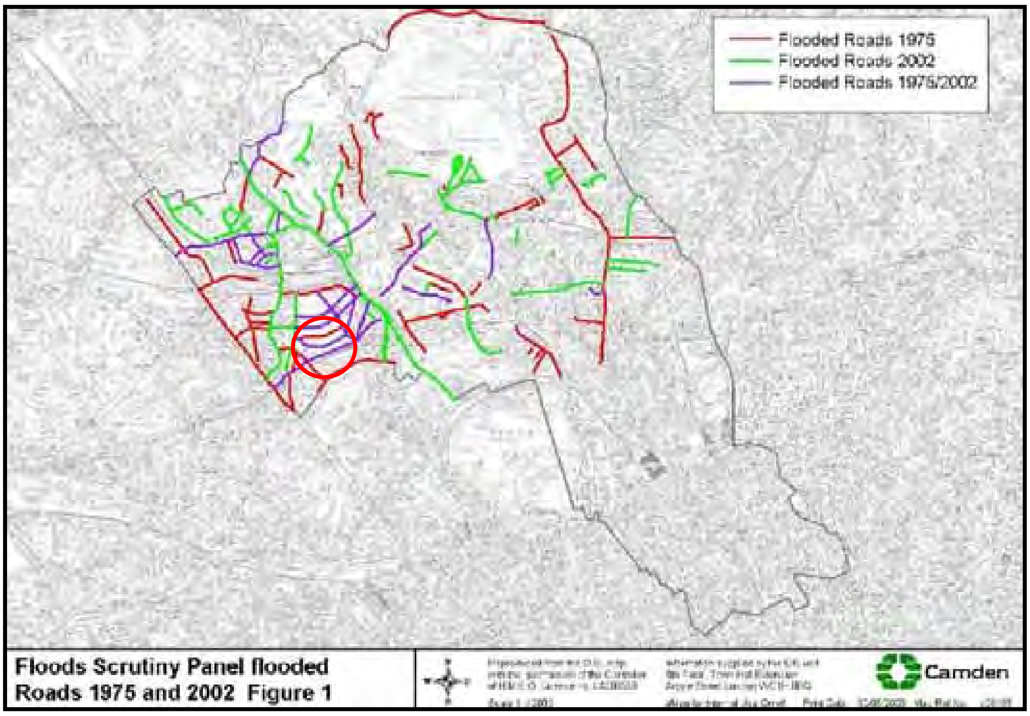


Figure 12a Flooded Roads 1975 and 2002

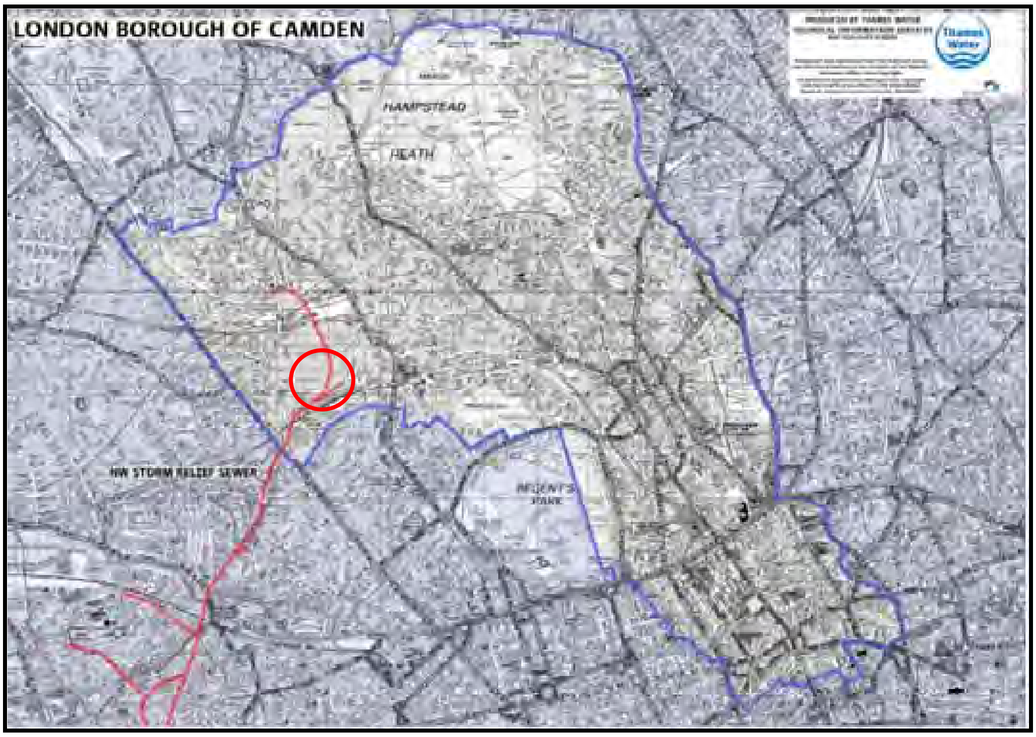


Figure 12b NW Storm Relief Sewer (shown in red)

7.3 Flood Risk From Rivers

The Flood Zone maps produced by the Environment Agency provide an initial assessment of flood risk. The Flood Zones are divided into four categories of flood probability and do not take into account any flood defences. PPS25 defines the flood zones as:

Zone 1: Low Probability-This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Zone 2: Medium Probability-This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% to 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% to 0.1%) in any year.

Zone 3: High Probability- This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Zone 3B 'The Functional Floodplain' – This zone comprises land where water has to flow or be stored in times of flood.

Camden lies entirely within Flood Zone 1 with a low probability of flooding from rivers or the sea.

Camden is not at risk from flooding from rivers. The closest surface water is the Regents Canal almost 1000m to the south.

Figure 13 1 in 1000 year Flood Event

The URS (2014) map above indicates a <0.75m flood hazard or low risk at 231 Goldhurst Terrace.

7.4 Flood Risk From Reservoirs

The Environment Agency are the enforcement authority for the Reservoirs Act (1975) and all large reservoirs are inspected and monitored by reservoir panel engineers. The risk of flooding from reservoirs is therefore very low. The Environment Agency Reservoir Flood Risk Maps for large reservoirs (>25,000m3) for this area indicate the site is at very low risk of flooding from reservoirs. There is a very low risk from the Hampstead Heath Reservoir 760m to the north west of the site as detailed in Figure 14.

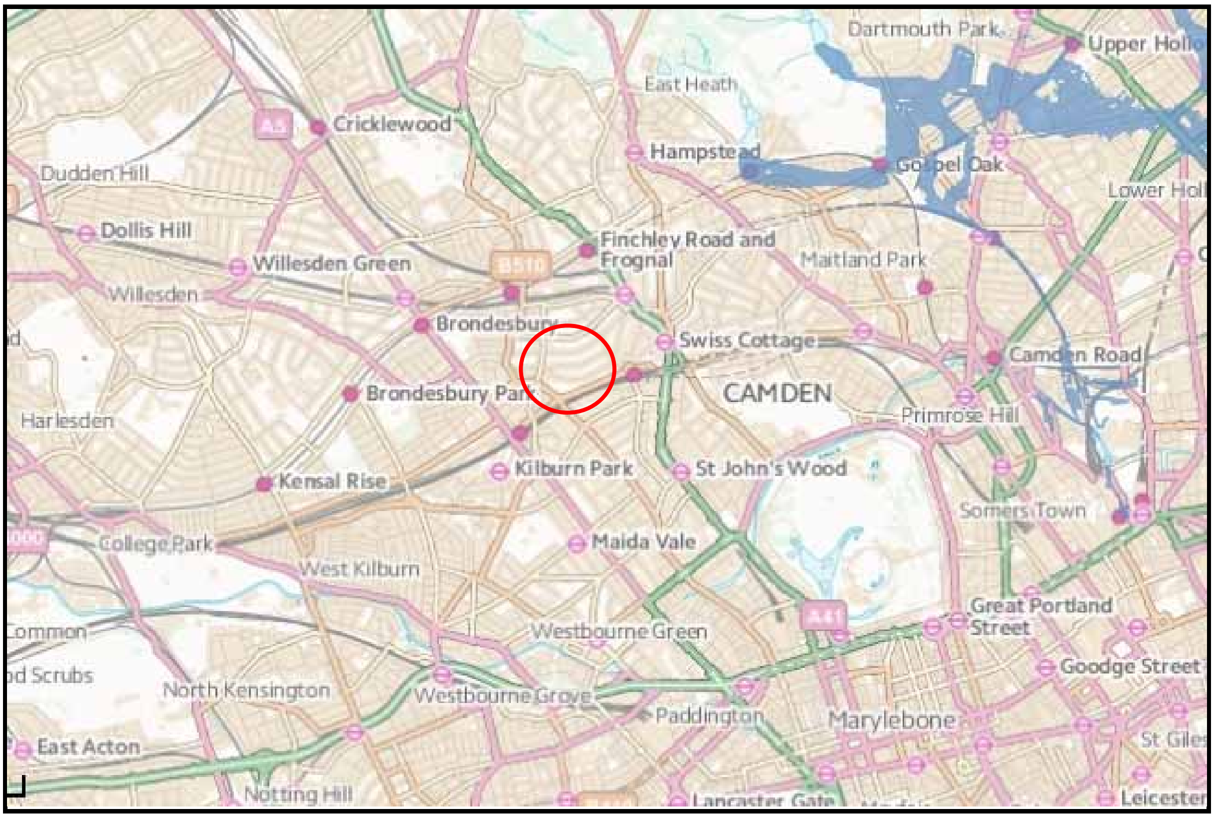


Figure 14 EA Flood Risk From Reservoirs

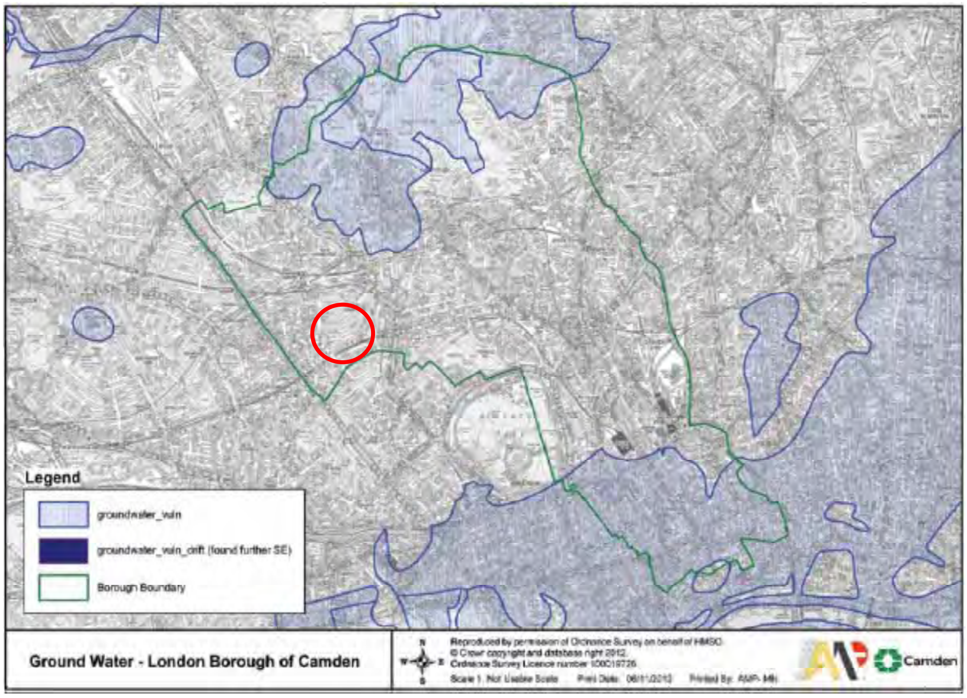
Below are the reservoirs that could affect this area.

Hampstead Pond No.1		
Reservoir Owner: Corporation of London		
Reservoir location (grid reference):527210, 185750	**Environment Agency Area:** North East Thames Area in South East Region	**Local Authority:**Camden

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency ensure that reservoirs are inspected regularly and essential safety work is carried out.

7.5 Flood Risk From Groundwater

According to the BGS there are no groundwater flood susceptibility flood areas within 50m of the site. There is according to the BGS a negligible risk of groundwater flooding based on the underlying geology.



Figures 15a and 15b Flood Risk

Figure 15a (EA) and Fig 15b (URS) above indicate no concern with flooding from groundwater on the site.

7.6 Flooding from sewers

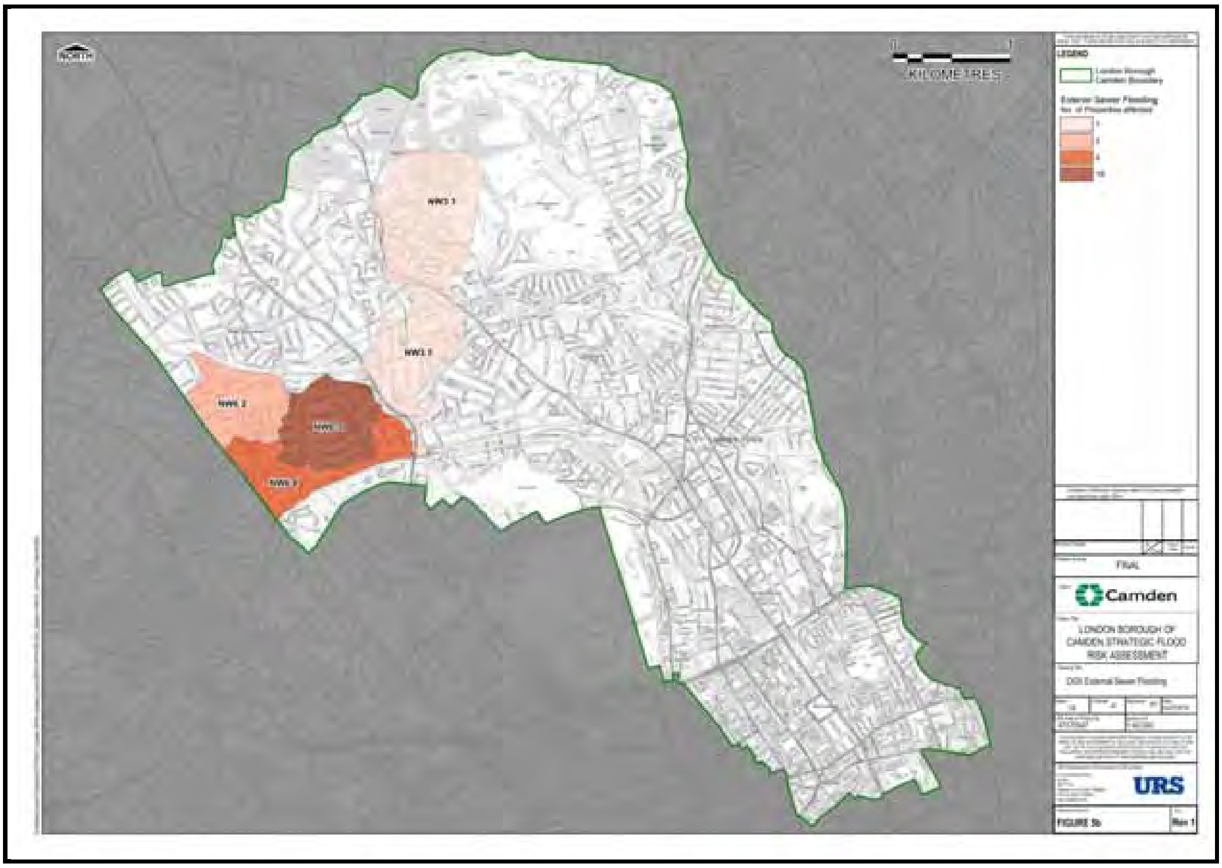


Figure 16 Sewer Flooding (URS 2014)

The URS (2104) Report states that 8 properties in the area of NW6 3 have been affected by internal sewer flooding and 18 have been affected by external sewer flooding.

7.7 Critical Drainage Area/Local Flood Risk Zone

The site lies within the Critical Drainage Area of Group 3_010 and in the Local Flood Risk Zone of Goldhurst as shown on Figure 17.

A Flood Risk Assessment was commissioned and is reported in Appendix D.

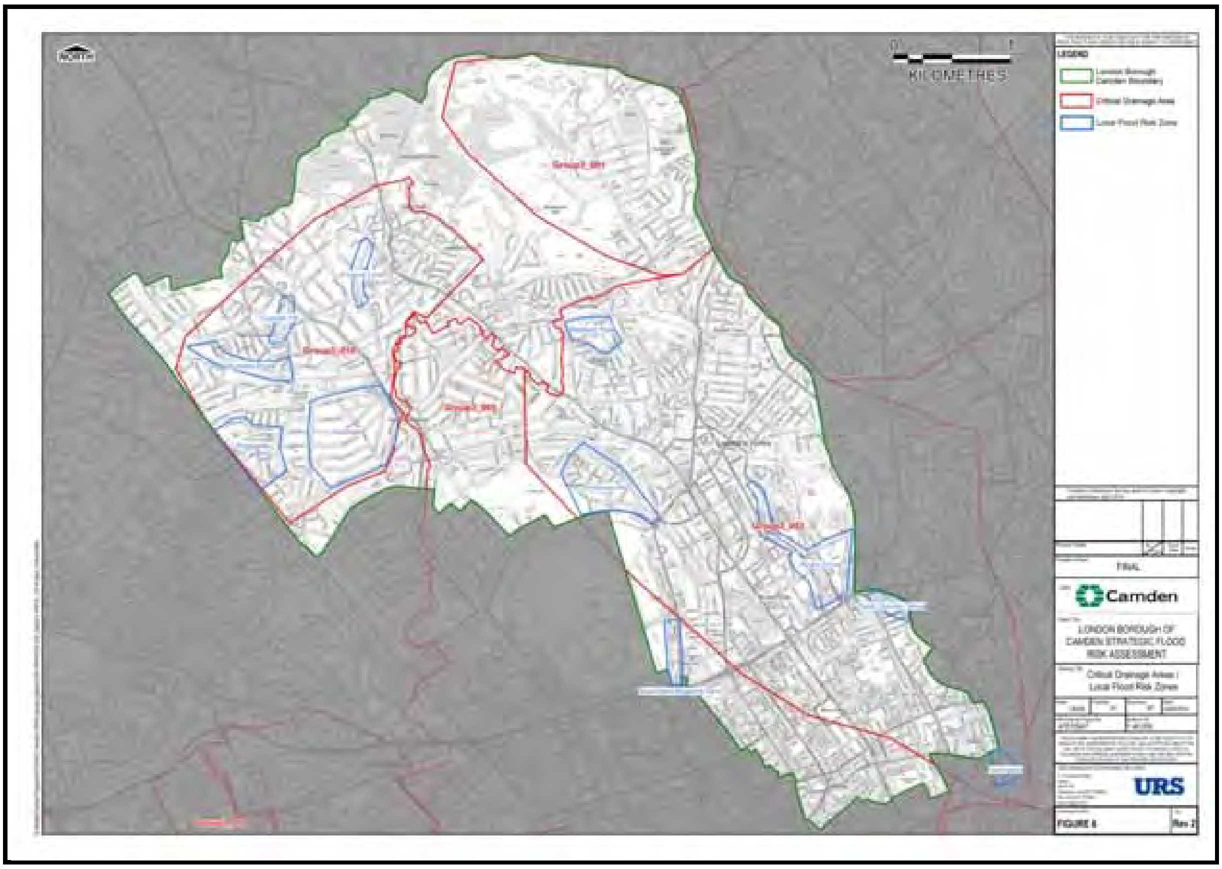


Figure 17 Critical Drainage Areas and Local Flood Risk Zones

8. LANDFILL

According to the Environment Agency there are no landfill sites within 250m of the site and therefore the site does not require monitoring for landfill gas and does not require landfill gas protection in construction of the basement.

There is a very low risk that the site is affected by radon gas and as such, radon protection measures will not be required in the basement as part of the proposed development.

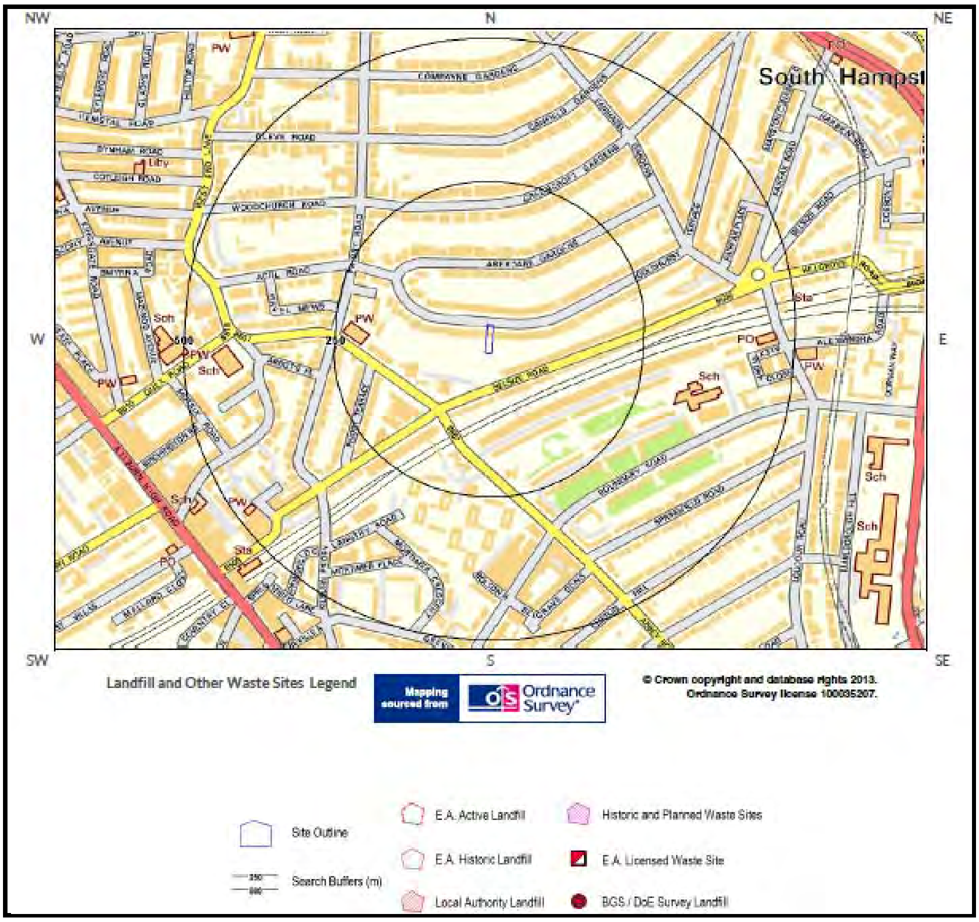


Figure 18 EA recorded Landfill Sites within 250m

9. REGULATED INDUSTRIES AND INFRASTRUCTURE

9.1 Regulated Industries

Results of searches for regulated industries are presented in Table 3.

TABLE 3
Authorisations, Incidents and Registers

Regulated Industry	On SITE	Within 250m	DETAILS
Historic IPC Authorisations	None	None	-
Part A(1) and IPPC Authorised Activities	None	None	-
Water Industry Referrals	None	None	-
Records of Red List Discharge Consents	None	None	-

Records of List 1 Dangerous Substances Inventory Sites	None	None	-
Records of List 2 Dangerous Substances Inventory Sites	None	None	-
Records of Part A(2) and Part B activities and enforcements	None	None	-
Records of Category 3 or 4 Radioactive Consents	None	None	-
Records of Licensed Discharge Consents	None	None	-
Records of Planning Hazardous Substance Consents and Enforcements	None	None	-
Records of COMAH and NIHHS sites	None	None	-
Records of National Incidents Recording System List 2	None	None	-
Records of National Incidents Recording System List 1	None	None	-
Records of sites determined as contaminated land under Section 78R of EPA 1990	None	None	-
Records of Made Ground	None	None	-
Records from EA landfill Data	None	None	-
Records of Operational Landfill Sites	None	None	-
Records of EA historic landfill sites	None	None	-
Records of non operational landfill sites	None	None	-
Records of local authority landfill sites	None	None	-
Records of operational waste treatment, transfer or disposal sites	None	None	-
Records of non operational waste treatment, transfer or disposal sites	None	None	-
Records of EA licensed waste sites	None	None	-
Current Industrial Land Use	None	4	114NE Electricity Substation, 161m SW Musical Instruments, 161m SW Giftware, 200m NW Electricity Substation.
Petrol and Fuel Sites	None	None	-
Underground High Pressure Oil and Gas Pipelines	None	None	-
Residential Property (within 250m)	Yes	Yes	Residential and commercial
Radon Protection Required	No	-	The property is not in a Radon Affected Area, as <1% of properties lie above action level.

Results of searches for regulated industries, pollution incidents or registered authorisations are presented in Table 3 above and indicate that potentially contaminative land uses are not present on and within close vicinity to the site and there are no records of an environmentally sensitive nature which could be detrimentally affected by the construction of a basement.

9.2 Infrastructure

Figure 19 Transport Infrastructure

The map in Figure 19 reproduced from the Camden Geological, Hydrogeological and Hydrological Study (Figure 18) indicates there is no transport infrastructure beneath the site.

10. SCREENING AND SCOPING

10.1 Screening

Screening is the process of determining whether or not there are areas of concern which require further consideration and / or investigation for a particular project. In order to undertake screening a site characterisation was undertaken in the previous sections. Scoping is the process of producing a statement which defines further matters of concern identified in the screening stage. This defining is in terms of ground processes in order that a site specific BIA can be designed and executed by deciding what aspects identified in the screening stage require further investigation by desk research or intrusive drilling and monitoring or other work.

The scoping stage highlights areas of concern where further investigation, intrusive soil and water testing and groundwater or gas monitoring may be required.

A series of flowcharts have been used in the screening process to identify what issues are relevant to the site. Each question posed in the flowcharts is completed by answering “Yes”, “No” or “Unknown”. Any question answered with “Yes” or “Unknown” is then subsequently carried forward to the scoping phase of the assessment.

The results of the screening process for the site are provided in Table 4 below. Where further discussion is required the items have been carried forward to scoping.

Scoping often indicates that a ground investigation is required to establish more fully the base conditions. The Basement Impact Assessment determines the potential impacts of the proposed basement on the baseline conditions, taking into account any mitigating measures proposed.

Table 4
Screening For Basement Impact Assessment

Ref	Question	Response	Details
	Surface Flow and Flooding		
1	Is the site within the catchment of the ponds chain on Hampstead Heath?	No	Refer to Maps
2	As part of the site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	Developer to provide proposed drainage details
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	Refer to Appendix A drawings. A reduction in lawned area Carried forward to Scoping
4	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	Surface water originating from the site is not received by adjacent properties or downstream watercourses (other than run-off to sewers).
5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	Surface water originating from the site is not received by adjacent properties or downstream watercourses (other than run-off to sewers).
6	Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King’s Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature? Does site lie within Critical Drainage Area?	Yes Yes	The road was affected by surface flooding in 1975 and in 2002. NW Relief Sewer constructed to alleviate surface water floods. The site does not lie below the water level of any surface water feature. Carried forward to Scoping
	Subterranean (groundwater) Flow		
7	Is the site located directly above an aquifer?	No	Site underlain by London Clay with Chalk Aquifer >100m bgl.
8	Will the proposed basement extend below the surface of the water table?	No, may be below perched	Site underlain by London Clay. Water table >100m bgl.

Table 4
Screening For Basement Impact Assessment

Ref	Question	Response	Details
		water	Carried forward to Scoping
9	Is the site within 100m of a watercourse, well (disused / used) or a potential spring line?	Yes within 100m of former watercourse	Historic watercourse of River Westbourne identified from "Lost Rivers of London" Now culverted in NW Relief Sewer. Carried forward to Scoping.
10	Is the site within the catchment of the pond chains on Hampstead Heath?	No	Refer to Appendix A
11	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Yes	Refer to Appendix A drawings. A reduction in lawned area Carried forward to Scoping
12	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	Refer to Appendix A. Soakaways unsuitable in London Clay discharge will be to public sewer.
13	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 (not just the pond chains on Hampstead Heath) or spring line?	No	No surface water feature within 1000m of the site.
	Ground Stability		
14	Does the existing site include slopes, natural or manmade, greater than 7°?	No	Refer to site description.
15	Will the proposed re-profiling of landscaping at site change slopes at the property to more than 7°?	No	Developer to provide details. Refer to Appendix A.
16	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	No	Refer to site description.
17	Is the London Clay the shallowest strata at the site?	Yes	London Clay has the potential to shrink and swell under varying moisture conditions Carried forward to Scoping
18	Will any trees be felled as part of the proposed development and / or are any works proposed within any tree protection zones where trees are to be retained?	No	No trees to be felled as part of proposed development.
19	Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	Yes	London Clay has potential Carried forward to scoping.
20	Is the site within an area of previously worked ground?	No	Unlikely
21	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	Site underlain by impermeable London Clay a non productive aquifer
22	Is the site within 50m of the Hampstead Heath ponds?	No	No it is 1000m distant
23	Is the site within 5m of a pedestrian right of way?	No	Goldhurst Terrace lies >5m from the basement.
24	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Possibly	Adjacent properties are unlikely to have basements. Depth of foundations to be confirmed. Carried forward to scoping
25	Is the site over (or within the exclusion of) any tunnels, e.g.	Unlikely	Site is not located over any

Table 4
Screening For Basement Impact Assessment

Ref	Question	Response	Details
	railway lines?		railway tunnels. Developer to confirm site does not overlie other tunnels such as water / Royal Mail / NW Sewer Carried forward to scoping.

In summary the issues carried forward to scoping include those associated with surface water flow and flooding, groundwater levels and the impact of the basement on the ground and on the ground supporting adjacent properties.

10.2 Scoping

Scoping is the activity of defining in further detail the matters to be investigated as part of the BIA process. Scoping comprises of the definition of the required investigation needed in order to determine in detail the nature and significance of the potential impacts identified during screening.

The potential impacts for each of the matters highlighted in Table 4 above are discussed in further detail below in Table 5 together with the requirements for further research and / or investigations. Detailed assessment of the potential impacts and recommendations are provided where possible.

Table 5
Scoping for Basement Impact Assessment

Reference	Issue	Potential Impact and Action
	Surface Flow and Flooding	
3	A reduction in lawned area	**Impact**: Increase in hard cover and surface water runoff. **Action:** Use of rainwater harvesting or drain to public sewer as soakaways unsuitable in London Clay.
6	The site was affected by surface flooding in 1975 and in 2002. NW Relief Sewer constructed to alleviate surface water floods. The site does not lie below the water level of any surface water feature. Site Lies within CDA of West Hampstead.	**Impact:** Potential for future surface flooding. **Action:** Design basement as waterproof building. Flood Risk Assessment required, and presented in Appendix D.
	Subterranean (groundwater) Flow	
8	Site underlain by London Clay, water table >100m, perched water at <1.00m bgl.(may be leaking drains)	**Impact:** Flooding of basement **Action:** Design basement as watertight. Install sump pump in basement patio if necessary. Non return valves on drains
9	Historic watercourse of River Westbourne identified from “Lost Rivers of London” Now culverted in NW Relief Sewer	**Impact:** Flooding of basement. **Action:** Flood Risk Assessment see Appendix D and see above in 8.

11	A reduction in lawned area of 25-50m2	**Impact**: Increase in hard cover and surface water runoff. **Action:** Use of rainwater harvesting or drain to town sewer. Ground unsuitable for soakaways.
	Ground Stability	
17	London Clay is the shallowest strata	**Impact**: Shrinkage and swelling **Action:** Soil Tests
19	London Clay has ability to shrink and swell under varying ground conditions. No evidence of damage to existing house.	**Impact:** Disturbance to foundations. Heave on excavation of basement. **Action:** Basement foundations will be below vulnerable zone. Suitable compressible material to be used in basement floor to accommodate heave.
24	Adjacent properties are unlikely to have basements. Depth of foundations to be confirmed.	**Impact:** Differential settlement to attached house. **Action:** Check depth of foundations to 231 and 233. Structural Report presented in Appendix E.
25	Site is not located over any railway tunnels. Developer to confirm site does not overlie other tunnels such as water / Royal Mail / NW Sewer	**Impact:** Stress changes in ground, damage to tunnels **Action:** Check to be made on location of Royal Mail/NW relief Sewer and other potential tunnels.

The scoping stage highlighted the need for:

- a ground investigation including soil testing
- groundwater monitoring
- Flood Risk Assessment
- SUDS to offset increased hard standing
- Geotechnical design
- Underground concrete design
- Search for underground tunnels
- Design of temporary and permanent works
- Check of foundation depths of attached property
- Rainwater Harvesting or other rainwater disposal
- Structural Engineering Report

It was recommended that an intrusive investigation should be undertaken to confirm ground conditions, test the London Clay for plasticity and sulphate content and monitor for groundwater levels and to undertake a Flood Risk Assessment. These are reported in Sections 11 and 12.

11 FLOOD RISK ASSESSMENT

11.1 Flooding by Surface Water and Reservoirs and Underground Rivers

Planning Policy Statement PPS25 "Development and Flood Risk" seeks to protect development from flooding as well as preventing flooding. PPS25 states that developers are responsible for providing a flood risk assessment:

- demonstrating whether any proposed development is likely to be affected by current or future flooding from any source;
- satisfying the local planning authority that the development is safe and where possible reduces flood risk overall;
- demonstrating whether the development will increase flood risk elsewhere;
- demonstrating measures proposed to deal with these effects and risks.

A Flood Risk Assessment is provided in Appendix D.

12. GROUND INVESTIGATION

12.1 Fieldwork

In order to confirm ground conditions beneath the site and to collect soil samples for testing for engineering properties of the strata a ground investigation was undertaken.

The ground investigation comprised the drilling of two 80mm diameter window sampler boreholes (WS1 to WS2) on Thursday August 21st 2014 and included insitu soil tests for strength and sampling of the soil for geotechnical testing.

12 soil samples were sent to a UKAS accredited laboratory and three were selected for testing for redox value and sulphate content. One window sampler borehole (WS2) was allocated for testing for groundwater and installed with a standpipe to facilitate monitoring.

Borehole results are presented in Table 6 and in Appendix C. Geotechnical Test Results are presented in Table 7 and Table 8 and Appendix C.

All exploratory points were marked out on site by reference to existing physical features on the site.

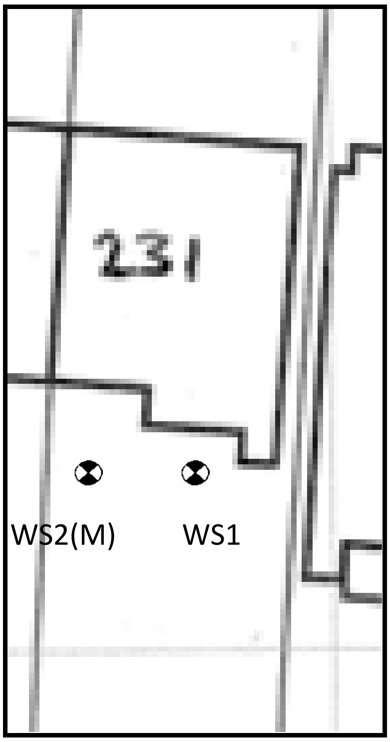


Figure 20 Borehole Location Plan

12.2 Ground Conditions

The ground conditions encountered in the window sampler boreholes comprised of a superficial covering of topsoil overlying made ground down to 0.75m to 0.80m bgl. The topsoil and made ground were everywhere underlain by low strength orange brown grey silty clay with flint gravel, underlain at 3.45m to 4.45m bgl by medium strength orange brown grey clay.

The ground conditions encountered are summarised in Table 6 below.

TABLE 6
Ground Conditions Encountered in WS Boreholes

Hole Ref.	TOPSOIL Depth in mbgl	MADE GROUND Depth in mbgl	CLAY (low strength) Depth in mbgl	CLAY (medium strength) Depth in mbgl
WS1	GL to 0.20	0.20-0.75	0.75-3.45	3.45-5.45
WS2	GL to 0.20	0.20-0.80	0.80-4.45	4.45-5.45

All soil samples selected for geotechnical testing collected were sent to Structural Soils Limited (SSL), The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ for geotechnical testing in order to determine engineering properties. SSL hold UKAS accreditation for the testing undertaken as detailed on the testing certificates.

A suite of geotechnical tests was scheduled by Ashton Bennett and redox value and sulphate content in accordance with BS1377:1990. The results are presented in full in Appendix C.

12.3 Geotechnical Test Results

12.3.1 Standard Penetration Test Results

The Standard Penetration Test (SPT) is undertaken in boreholes by means of a standard 50.80mm outside diameter split spoon sampler to determine the approximate in situ density of soils and when modified by a cone end (CPT) the relative strength or deformity of rock.

TABLE 7
Standard Penetration Test N Value Results (SPT)

Depth in m	Made Ground	Clay low strength	Clay medium strength
GL-1.00			
1.00-1.45		4, 5	
2.00-2.45		8, 8	
3.00-3.45		9	10
4.00-4.45		8	15
5.00-5.45			15, 16

The SPT N values indicate the clay to be low to medium strength. Made ground should always be considered as in a loose state of compaction.

12.3.2 pH and Sulphate Test Results

Two soil samples were tested for redox value and sulphate content to assess the design of underground concrete.

TABLE 8
pH and Sulphate Test Results

Sample	Depth in mbgl	pH	Sulphate mg/l
WS1	1.50	7.87	2410
WS2	2.50-3.00	8.02	939

The results indicate that considerations are required for design of underground concrete for foundations. According to BRE Special Digest 1 the ACEC Class for underground concrete is DS3-AC-2s. The elevated sulphate encountered is due to selenite, a calcium sulphate in the London Clay.

12.3.3 Atterberg Limit Test Results

Atterberg Limit Tests were undertaken on two samples from WS1 at 2.00m and WS2 at 3.00m bgl. The results indicate the clays are clays of high plasticity and likely to shrink and swell under varying moisture conditions in the ground. This should be taken into account in design of expanding material beneath the floor slab.

TABLE 9
Atterberg Limit Test Results

BH No	Depth in m	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %
WS1	2.00	33	78	26	52
WS2	3.00	34	74	24	50

12.4 Engineering Properties of Strata Tested
12.4.1 Topsoil and Made Ground

Topsoil and Made Ground are very variable both laterally and vertically and no test results should be assumed to represent the entire sequence. The made ground is likely to be in a loose state of compaction and highly compressible.

Topsoil and Made Ground are unsuitable material on which to place foundations without ground treatment.

12.4.2 Clay

SPT results in the clay indicate it to be generally low to medium strength with N values of 4 to 16. The clay was tested for plasticity and found to have a high plasticity and highly likely to shrink and swell under varying moisture conditions in the ground.

Based on the SPT results the clay has an allowable bearing capacity of 28 to 63kN/m^2 increasing to 70 to 112kN/m^2 below 4m bgl, taking into account a Factor of Safety of 3.

12.5 Groundwater Conditions

Groundwater was not encountered during drilling. Groundwater was encountered during monitoring at depths of 0.25m to 1.56m bgl. The water was proven by laboratory testing to be foul water from a sewer. The sewers will be reconstructed as part of the new development.

In summary it is expected that limited perched groundwater may be encountered within the made ground during construction, however inflows into excavations are unlikely to be significant and are expected to be dealt with by sump pumping.

12.6 Gas Conditions

As there are no recorded landfill sites within 250m of the site and no significant made ground, monitoring for landfill gas was not required. There is a very low risk that the site is affected by radon gas and as such, radon protection measures will not be required in the basement as part of the proposed development.

13. IMPACT ASSESSMENT
13.1 Introduction

The BIA has been undertaken for the proposed construction of a new basement. The depth of the basement is anticipated to be 1.5m to 2.5m bgl. The anticipated bearing pressure of the new structure has not been provided.

The comprehensive desk based assessment together with the site inspection and ground investigation and flood risk assessment have been sufficient to allow the potential impacts of the issues identified during the screening and scoping stage of the project to be assessed.

This section of the report provides an interpretation of the findings of the Desk Study and Ground Investigation, in the form of a ground model, and provides advice and recommendations with respect to temporary and permanent works and foundation options. The detailed Flood Risk Assessment and Structural Engineers Report are appended.

13.2 Geological and Hydrogeological Setting

With regard to the geology and hydrogeology of the site, the report concludes that the site is immediately underlain by up to 0.80m of topsoil and loose made ground, underlain by 4.65m of low to medium strength silty clay representing the weathered surface of the London Clay. The London Clay is highly plastic in nature and has a high sulphate content due to the included selenite.

The London Clay is relatively impermeable and is classified by the Environment Agency as a non productive aquifer. There are no recorded abstraction licences which could be detrimentally affected by the basement development.

There was no recorded groundwater during the ground investigation, groundwater was monitored at levels of 0.25m to 1.56m bgl in the standpipe in weeks following the ground investigation. This is a high level considering the impermeable nature of the London Clay and was proven by laboratory testing to be from the foul drains. These will be relaid during the new development.

13.3 Hydrology and Flood Risk

There are no surface water features within 100m of the site which could affect the development. The River Westbourne used to flow circa 100m to the east and is now culverted and unlikely to detrimentally affect the site or be affected by the site.

There is a small proposed change of hard cover which could slightly increase run off. The site is not suitable for soakaways due to the underlying impermeable London Clay.

Goldhurst Terrace was affected by the 1975 and 2002 floods and a Flood Risk Assessment has been completed and is presented in Appendix D.

13.4 Contamination

Ordnance Survey maps inspected indicated the site was an open field before construction of No 231 house around 1935. As such there is a low risk of contamination being present on the site. The ground investigation did not reveal any soil that contained potentially contaminating or odorous material. As a precaution all builders should also use gloves when handling soil for Health and Safety and work in accordance with HSE and CIRIA guidelines.

13.5 Basement Excavations

The excavation for the basement will be 2.50m below existing ground floor level or 1.50m below existing ground level in the rear garden. The basement floor formation level will be on the London Clay. In order to form the floor beyond the influence of the zone of shrinking and swelling in the London Clay it is advisable to form the floor at least 0.90m below ground level.

Excavation in the made ground and clay could be achieved by mechanical excavator.

Groundwater is unlikely to be encountered except during and after heavy rainfall when a sump pump is expected to deal with the water ingress. If rainwater falls into the excavation it can easily be dealt with by sump pumping. If this occurs the softened surface of the clay strata should be removed prior to any pouring of concrete for the basement floor.

Excavations for the proposed basement structure will require temporary support in all strata to maintain stability of the surrounding structures and to prevent any excessive horizontal ground movements. Refer to Structural Engineers Report in Appendix E.

Construction of the proposed basement will need to be supported by new retaining walls. Formation level for the proposed development will be the London Clay beneath any topsoil or made ground which are unsuitable bearing strata. The London Clay should provide a suitable bearing stratum for underpinned foundations, a box construction or piles whichever is required based on the bearing pressure or ground loading of the structure.

The basement support for the temporary and permanent conditions must take account of maintaining the stability of the excavation and the stability of the adjacent properties and surrounding structures. Design of the walls may be decided as to whether the temporary support is also incorporated into the permanent solution.

The potential for ground movement during the excavation and construction of the basement has to be considered. Any significant ground movements could cause structural damage to adjacent properties. Ground movement could occur from heave of the ground following removal of overburden. For clay subsoils this effect is not usually significant.

Following the excavation of the basement, it is possible that the floor slab for the proposed basement will need to be suspended over a void to accommodate the anticipated heave, unless the slab can be suitably reinforced to cope with these movements or a layer of compressible material added to accommodate the heave. In accordance with Eurocode 7

(BSEN 1997-1) groundwater should be taken at ground level for short and long term design. Such design must resist the buoyant uplift pressures generated by groundwater at ground level. For this basement the uplift pressure used for design should be 25kN/m2.

13.6 Basement Retaining Walls

The following parameters are recommended for design of retaining walls:
Made Ground: 1600kN/m2 Bulk Density, Effective Cohesion of 0kN/m2, 20 degrees Effective Angle of Friction.
London Clay: 2000kN/m2 Bulk Density, Effective Cohesion of 0kN/m2, 26 degrees Effective Angle of Friction.

Groundwater should be taken as ground level. The basement should be designed as water proofed and to accommodate groundwater pressures in line with BS 8102:2009.

13.7 Foundation Design

Foundations should be placed below the shrink and swell zone of the London Clay and in unweathered strata where a net allowable bearing pressure of 70 to 112kN/m^2 can be used for design.

13.8 Adjacent Structures

The development of the basement may impact on adjacent properties if mitigating measures and appropriate temporary and permanent design are not undertaken.

Care should be taken to design a retention system that maintains stability to all adjacent structures at all times during the works. It would be prudent to investigate the depth of foundations of the adjacent property before construction.

It would be prudent to undertake a structural condition survey of adjacent properties on both sides of No 231 before work commences.

The proposed basement will not lie within 5m of the pavement of Goldhurst Terrace. Lateral movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of any footpath or services.

13.9 Underground Concrete

Results of testing for the presence of pH and sulphates in the clay indicate an elevated level of sulphates due to the presence of selenite. The recommendations for design of underground concrete is ACEC class DS3-Ac-2s from Table C2 of BRE Special Digest 1 Part C (2005). This assumes a static water condition on natural strata.

13.10 Service Excavations

Shallow excavations for services and the like are unlikely to be stable in the made ground in the short or long term and may require battering. Excavations within the clay may be stable in the short term but not the long term. Some sump pumping may be required to keep the trenches dry.

13.11 Waste Disposal

Any spoil arising from excavations or landscaping works will need to be disposed of to a licensed tip. Under the European Waste Directive landfills are classified as accepting inert non-hazardous or hazardous wastes in accordance with the EU Waste Directive. Based on the technical guidance provided by the Environment Agency it is considered likely that the soil from this site, would be classified as INERT waste

The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material but may require Waste Acceptance Criteria Tests (WACS) testing.

13.12 Existing Tunnels

The proposed basement excavation will not be within the zone of influence of any of the London Underground (rail) tunnels shown on Figure 18 of Arup Report for London Borough of Camden “Guidance for Subterranean Development”, 2010).

It is possible that other tunnels owned and maintained by other service providers may exist beneath the site that could be affected by the proposed excavation and construction works.

It will be necessary to undertake a full search of potential tunnels that may underlie the site. On the assumption that it is confirmed that the site is not within the “zone of influence” of any underlying tunnels then no further activities in this regard will be required (the zone of influence is normally defined as the strip of land present above a tunnel with boundaries defined from a line drawn at 45° from the invert level of the tunnel to the ground surface). Alternatively, it will be necessary to liaise with the tunnel owner and undertake further engineering analysis to determine the potential impacts that the proposed basements could have on the tunnel.

13.13 Recommendations

The development of the basement if unlikely to impact on groundwater, surface water or flooding, unlikely to impact on drainage or ground infiltration of rainwater.

It will be necessary to ensure that the basements are designed in accordance with the NHBC Standards and take due cognisance of the potential impacts highlighted above. This may be achieved by ensuring best practice engineering and design of the proposed scheme by competent persons and in full accordance with the Construction (Design and Management) Regulations. This will include:

- Establishment of the likely ground movements arising from the temporary and permanent works and the mitigation of excessive movements;
- Assessment of the impact on any adjacent structures
- Determination of the most appropriate methods of construction of the proposed basements;
- Undertake pre-condition surveys of adjacent structures;
- Monitor any movements and pre-existing cracks during construction;
- Establishment of contingencies to deal with adverse performance;
- Ensuring quality of workmanship by competent persons.

Full details of the suitable engineering design of the scheme in addition to an appropriate construction method statement are presented in Appendix E.

14. GENERAL REMARKS

This report truly reflects the conditions found during the desk study and ground investigation. Whilst the desk study and ground investigation were undertaken in a professional manner taking due regard of additional information which became available as a result of ongoing research, the results portrayed only pertain to the information attained, and it is possible that other undetected information and undetected ground and gas conditions, undetected mining conditions and undetected contamination may exist. The investigation was only undertaken within the site boundaries and should not be used for interpretation purposes elsewhere. These conclusions are only a brief summary of the report, and it is recommended that the report is read in full to ensure that all recommendations have been understood.

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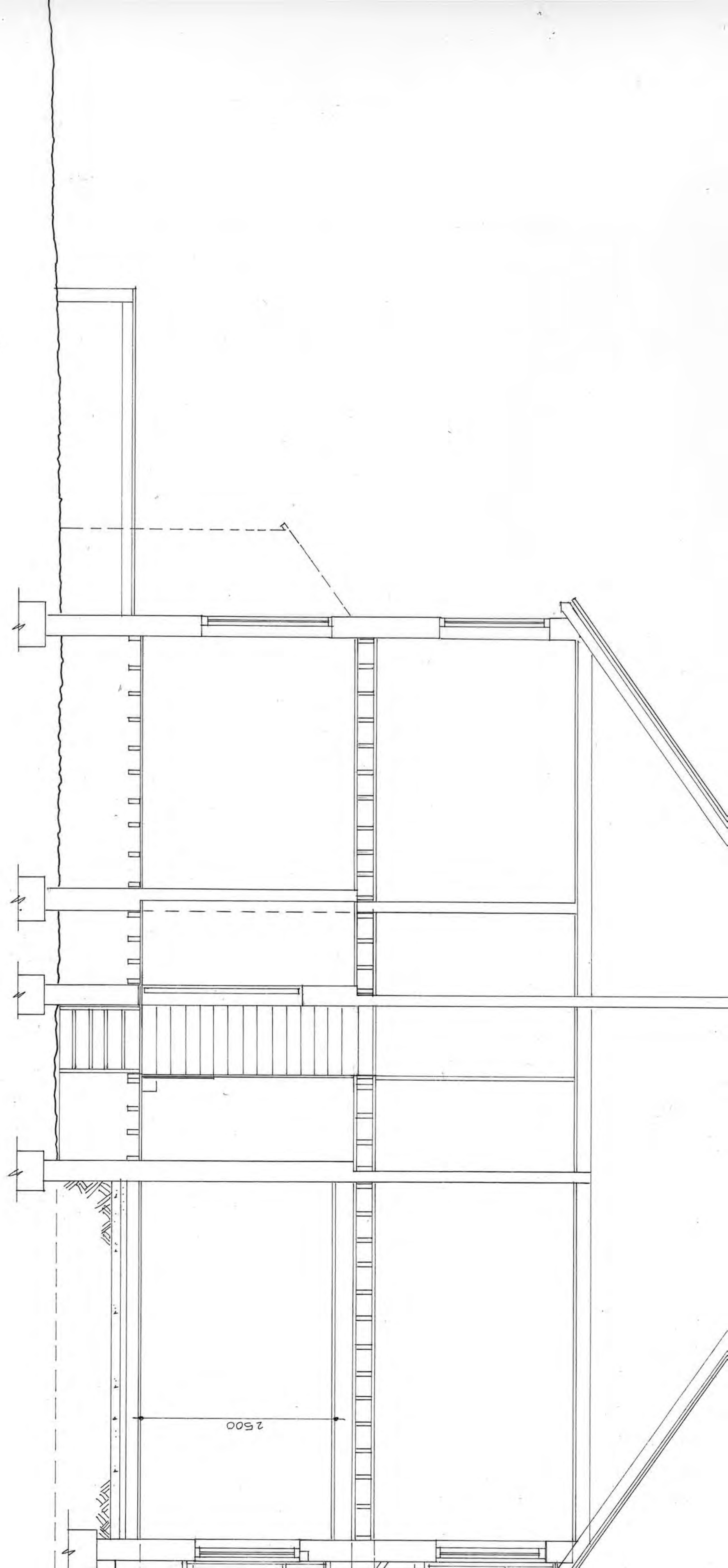
BSc, CGeol, FGS, FIMMM, C.WEM, MCIWEM, CEnv, AIEMA, MIEnvSci.

Appendix A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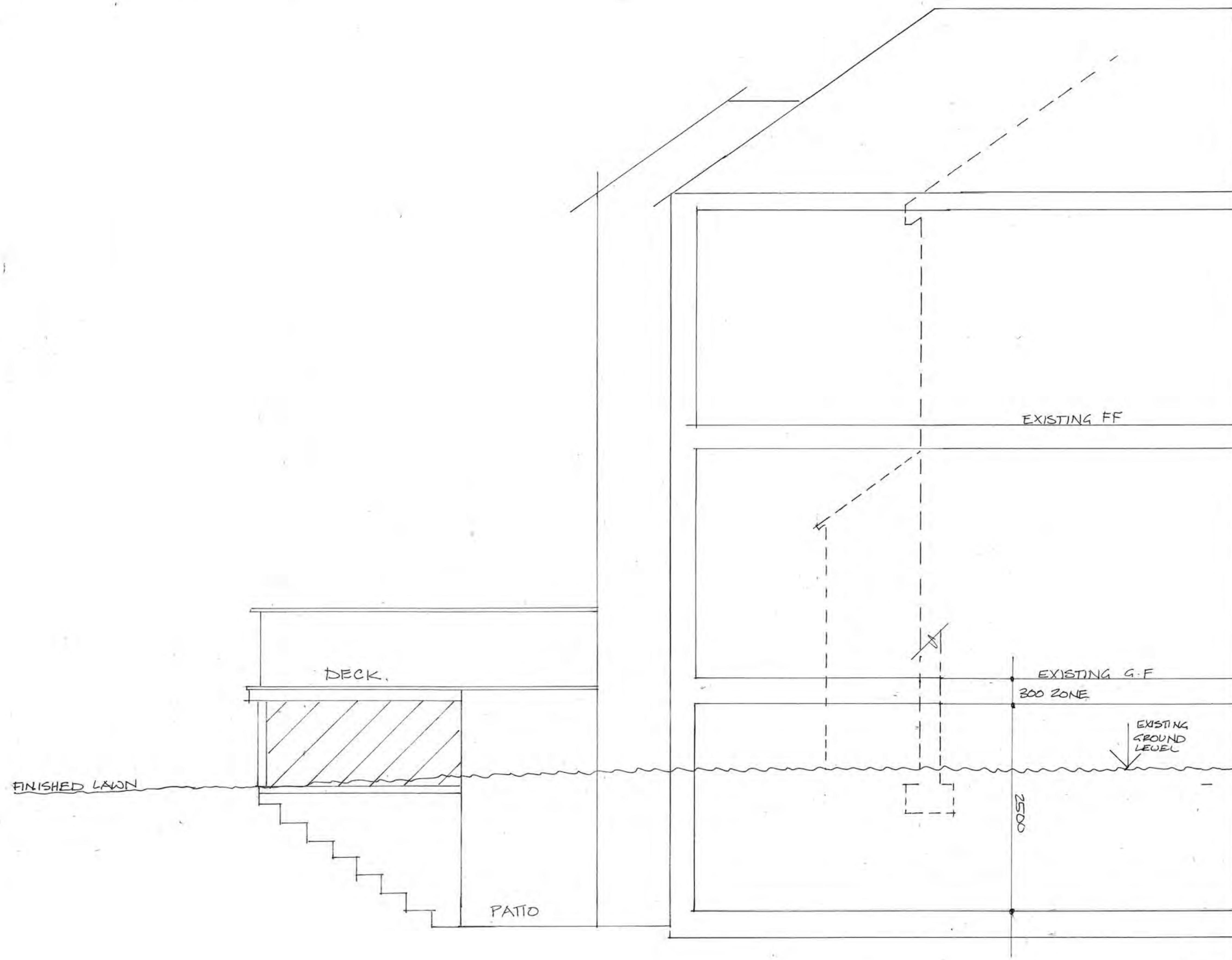

Notes:
All dimensions must be checked on site and not scaled from this drawing.

MSA
MURRAY-SMITH
ARCHITECTS
Sarah Murray-Smith
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16 KIRK CLOSE
OXFORD OX2 8JN
TEL/FAX 01865 310199
MOBILE 0794 106 3013
msarchitects@btconnect.com

Client
ZUR-SZPIRO

Job
231 GOLDHURST TERRACE

Drawing
SECTION
GARDEN / NEW BASEMENT

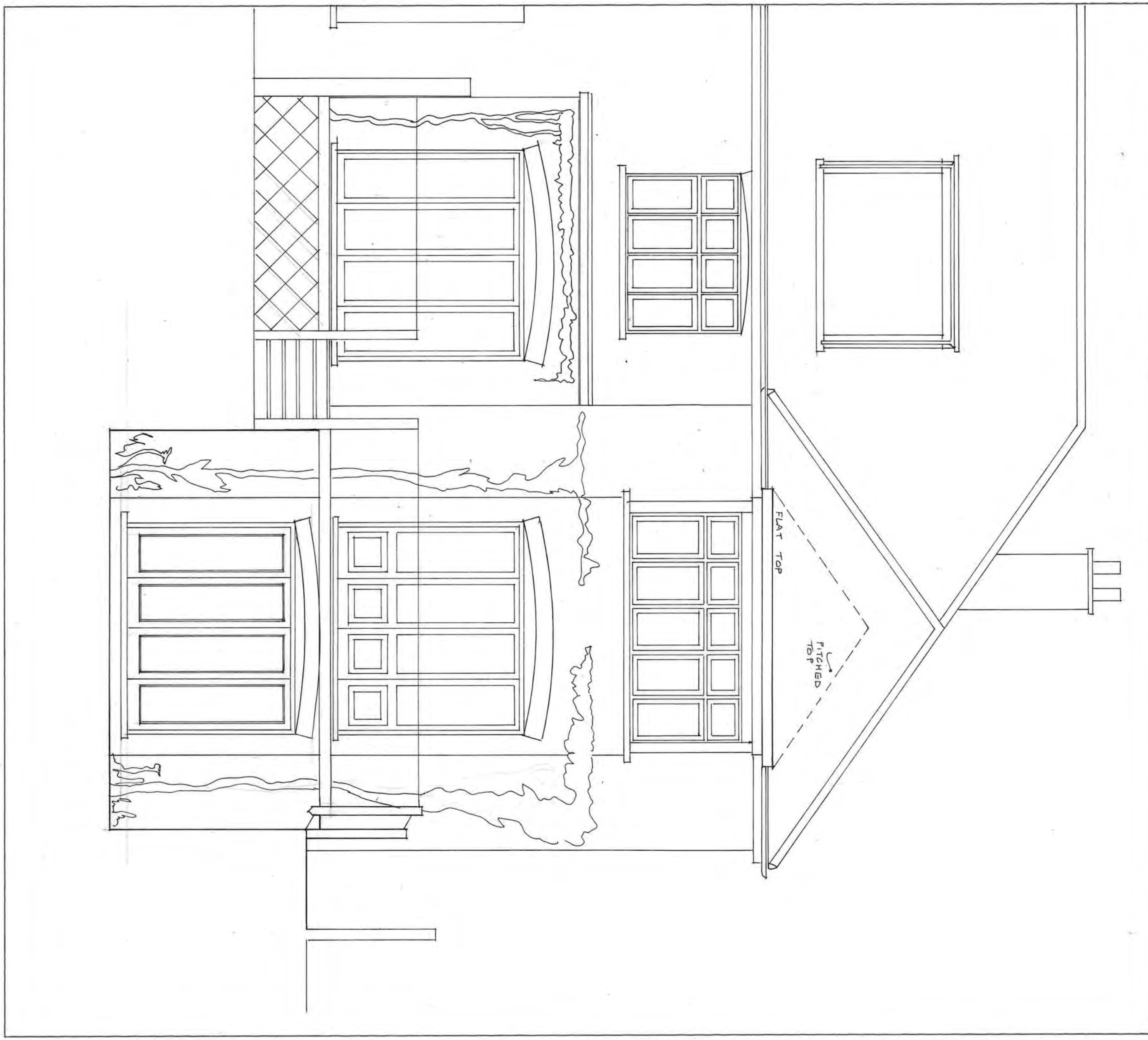
Scale
1:50

Date
AUG 2014

Drawn by
SMS

Drg. No.
Z-S13 :

Rev.



Notes:
All dimensions must be checked on site and not scaled from this drawing.

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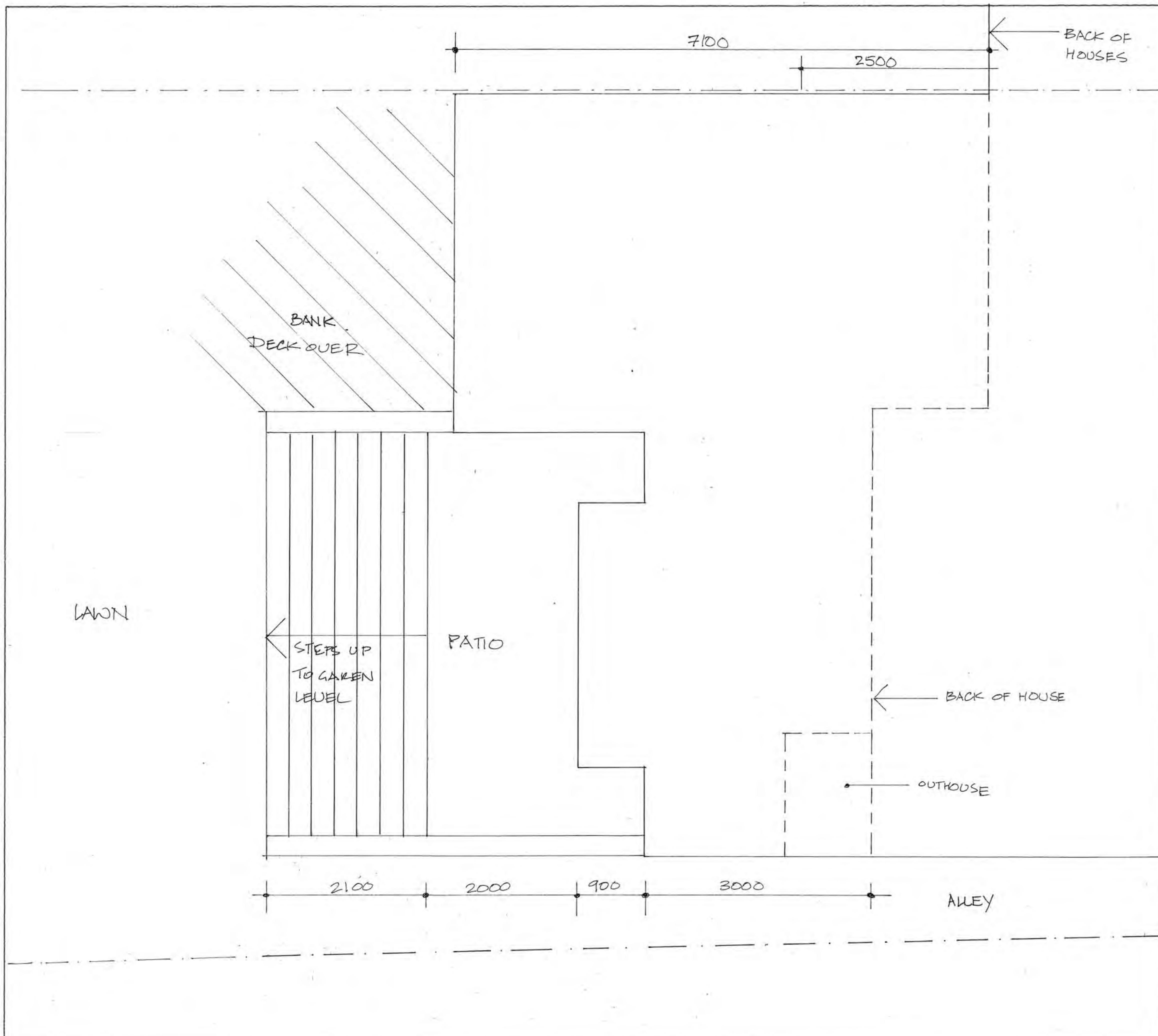
Client	ZUR - SZPIRO
Job	231 GOLDHURST TERRACE
Drawing	REAR ELEVATION PROPOSED
Scale	1:50
Date	APRIL 2014
Drawn by	SMS
Drg. No.	Z-513: EL SK 15
Rev.	



Notes:
All dimensions must be checked on site and not scaled from this drawing.

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Client: ZUR- SZPIRO

Job: 231 GOLDHURST TERRACE

Drawing: BASEMENT DIMS TO REAR

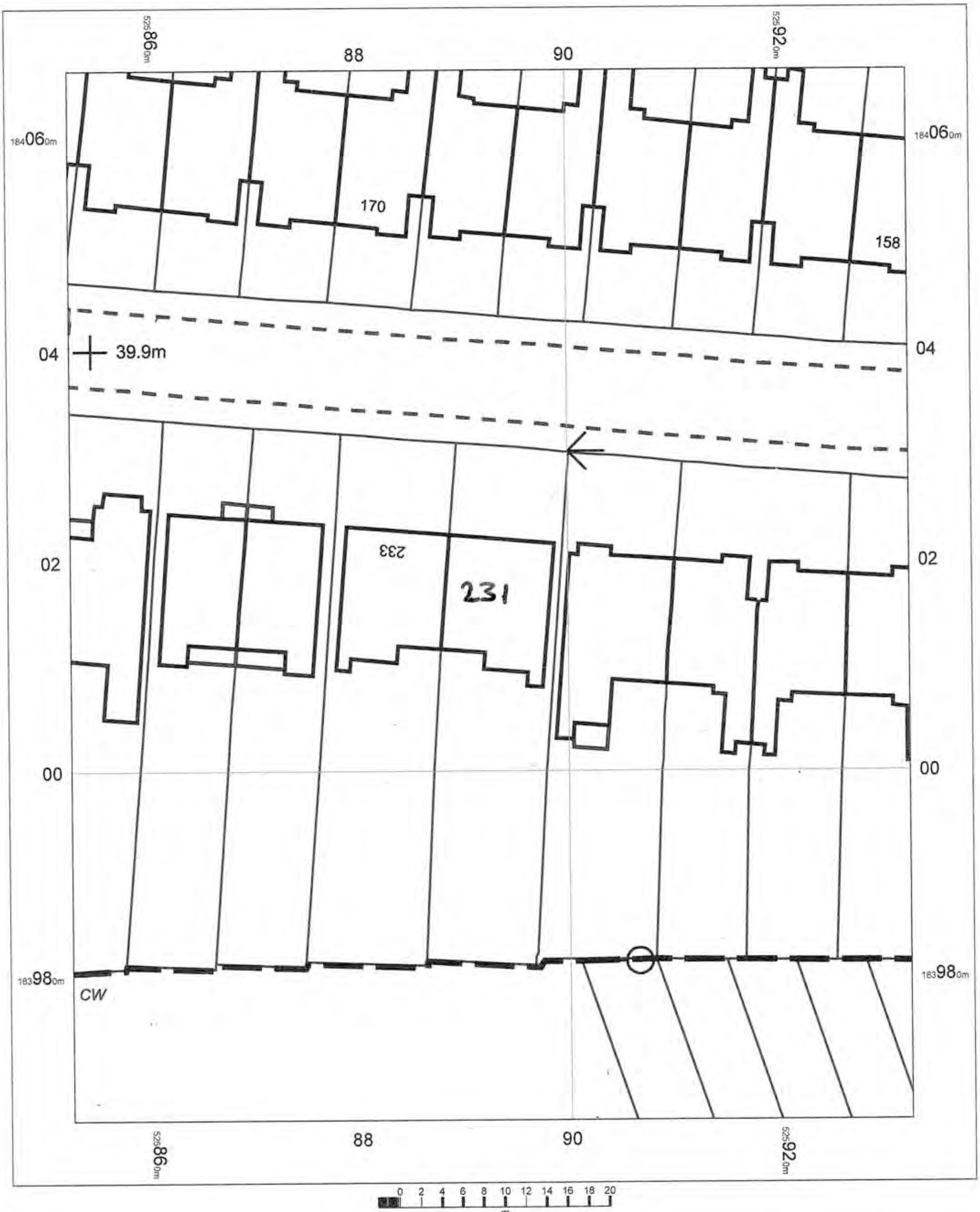
Scale: 1:50

Date: AUG 2014

Drawn by: SMS

Drg. No.: Z-513 : SK18

Rev.:

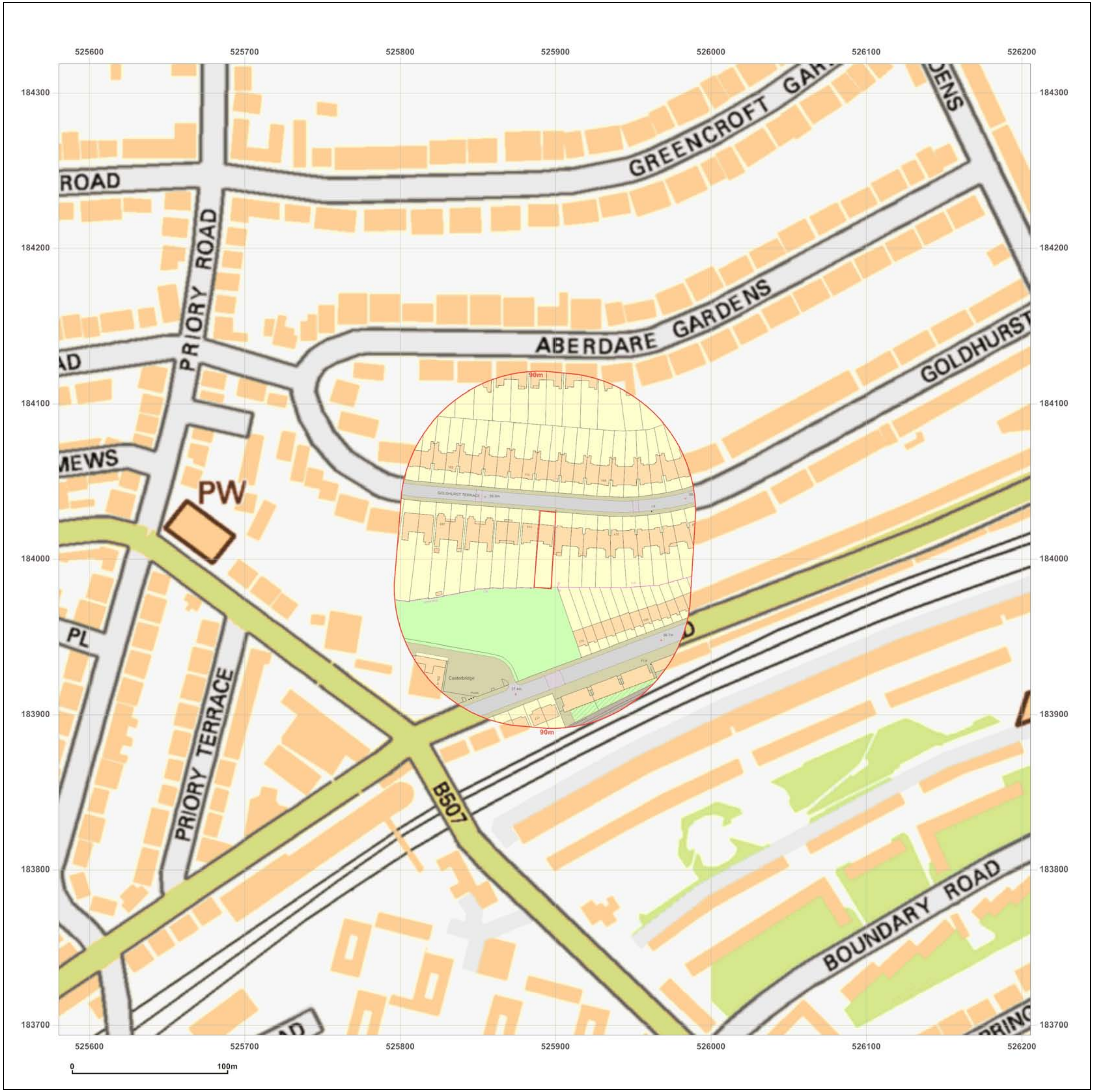


N

OS MasterMap 1250/2500/10000 scale
15 August 2014, ID: JEW-00352433
maps.johnewright.com

1:500 scale print at A4, Centre: 525892 E, 184017 N

Appendix **B**



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Site Details:

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Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: MasterMap

Map date: 2012

Scale: 1:1,250

Printed at: 1:2,500

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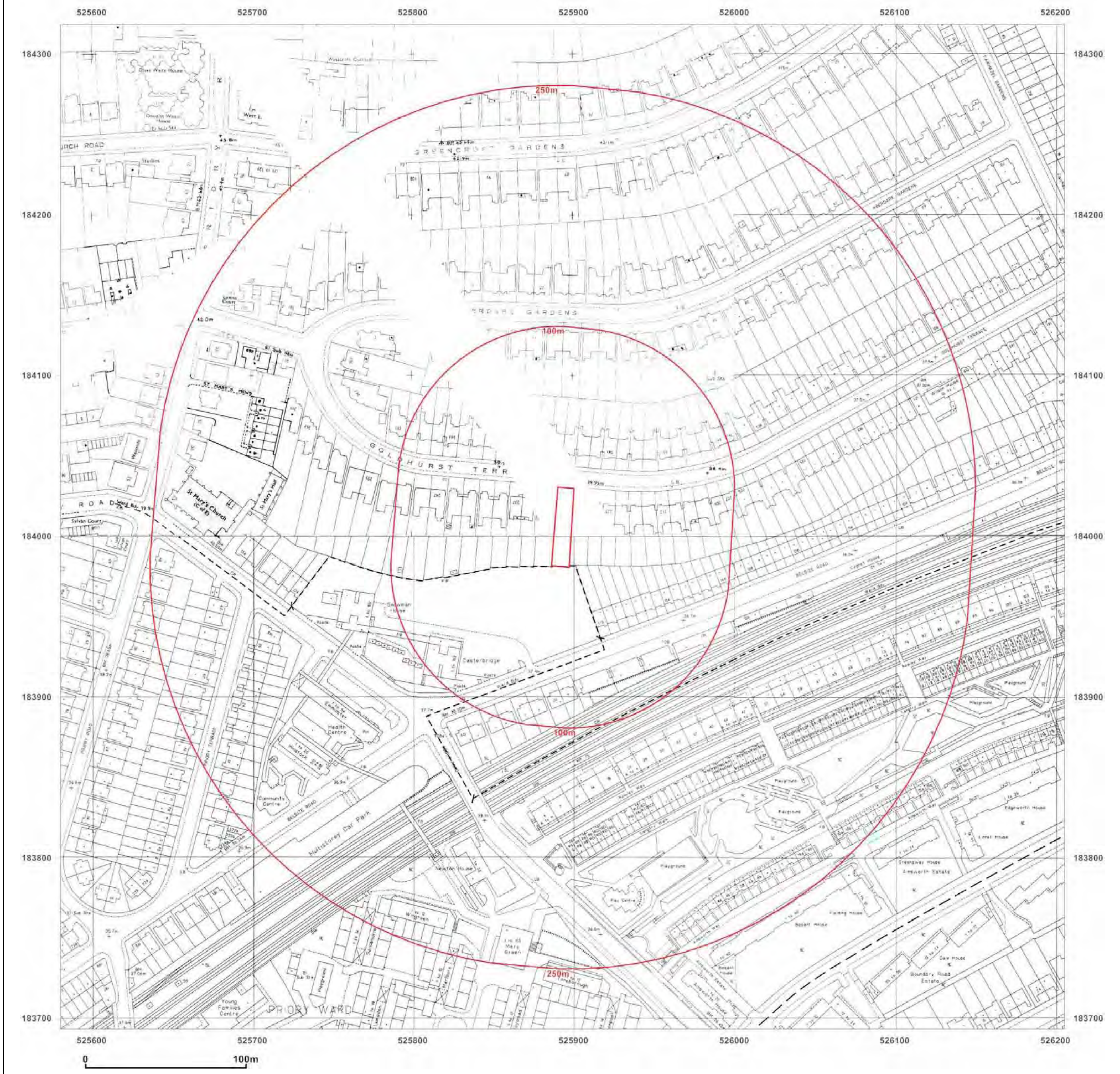

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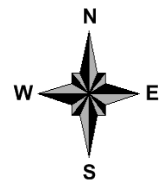
Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: **1990-1991**

Scale: 1:1,250

Printed at: 1:2,500



Surveyed 1974 Revised 1990 Edition N/A Copyright 1990 Levelled 1974	Surveyed 1991 Revised 1991 Edition N/A Copyright 1991 Levelled N/A
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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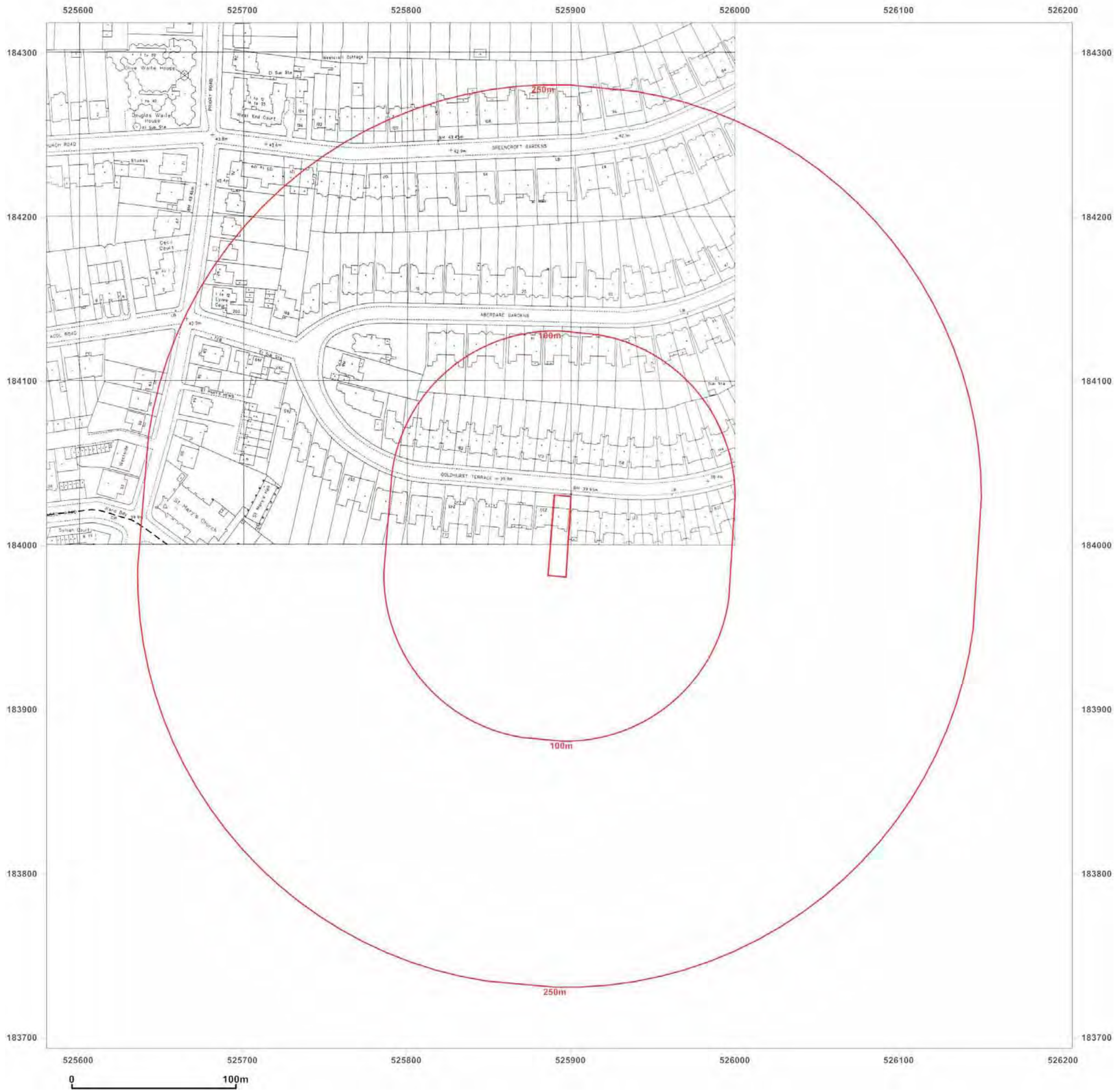

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Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: 1991

Scale: 1:1,250

Printed at: 1:2,500

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Surveyed 1991
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Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: 1990

Scale: 1:1,250

Printed at: 1:2,500

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Revised 1990
Edition N/A
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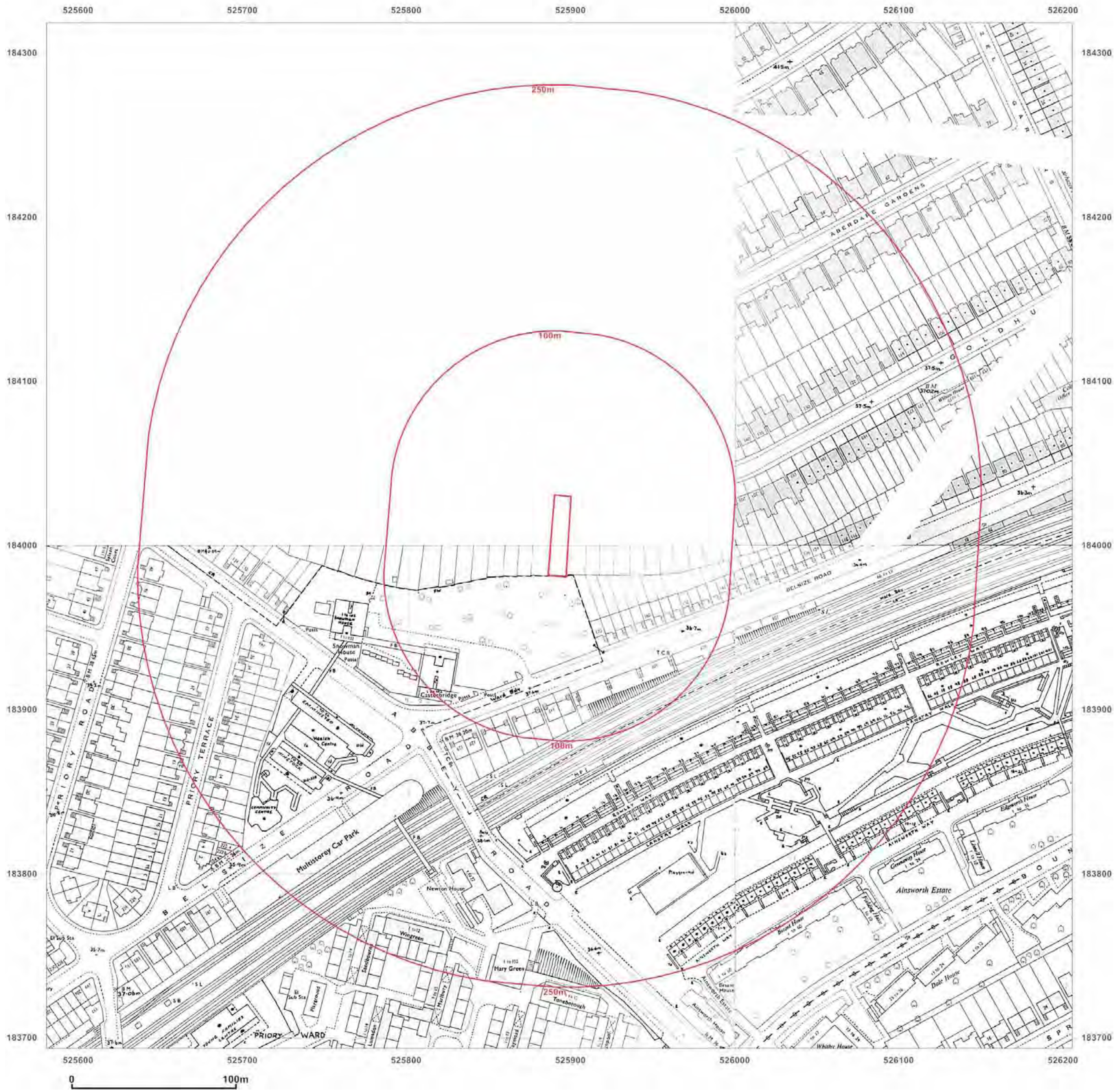

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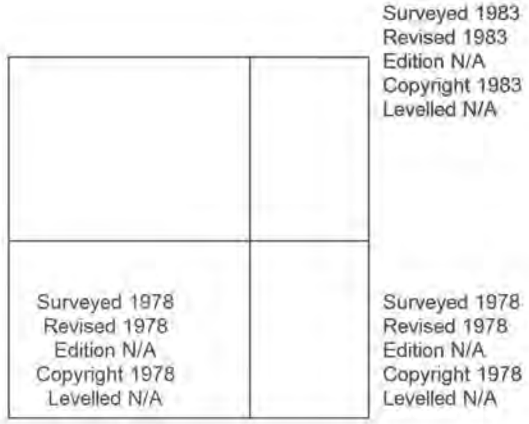
Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: **1978-1983**

Scale: 1:1,250

Printed at: 1:2,500



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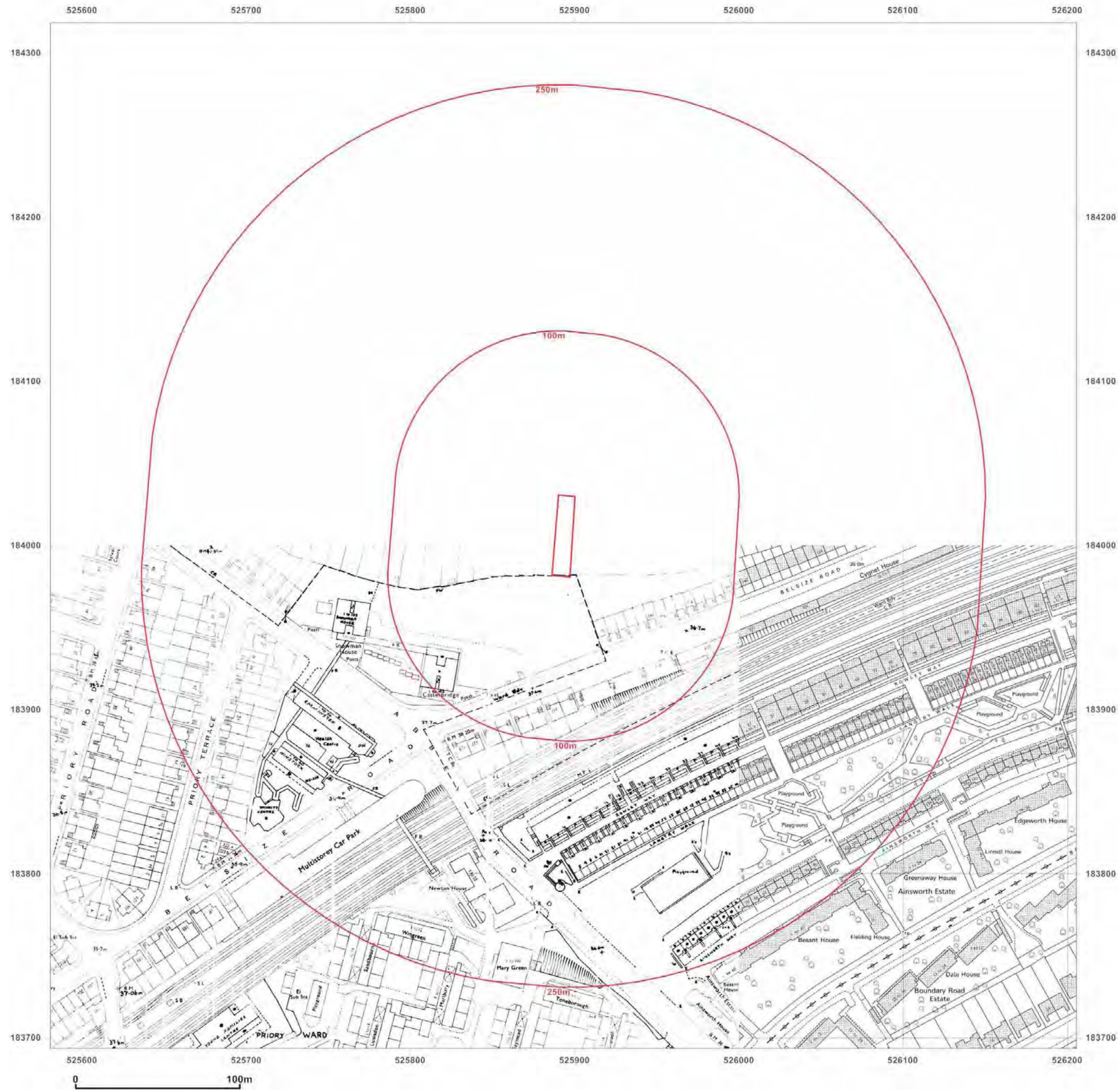

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Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: **1979-1983**

Scale: 1:1,250

Printed at: 1:2,500

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

Surveyed 1953
Revised 1983
Edition N/A
Copyright N/A
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Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: **1972**

Scale: 1:1,250

Printed at: 1:2,500

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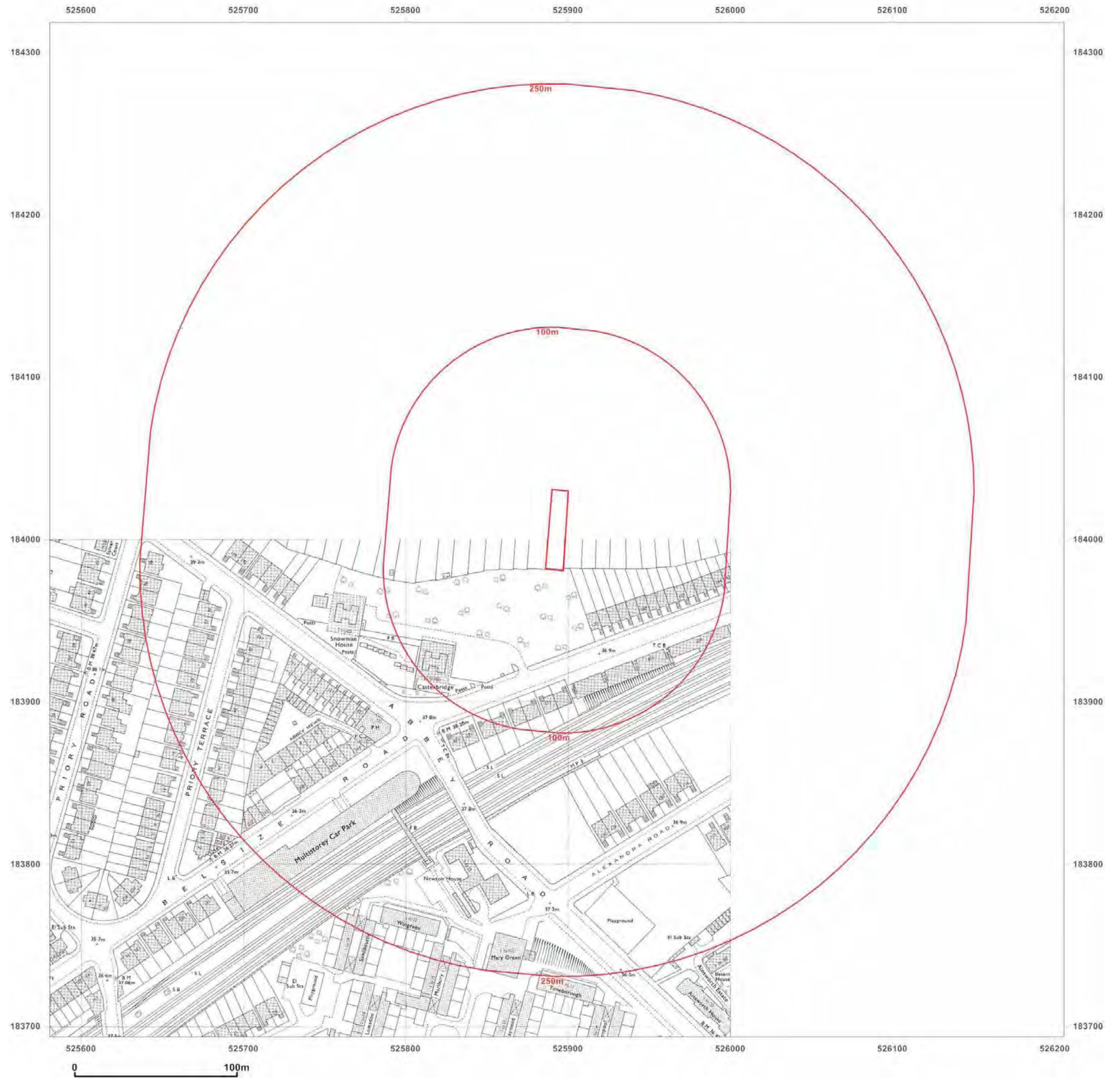
Surveyed 1953
Revised 1971
Edition N/A
Copyright 1972
Levelled 1953



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Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: **1965-1970**

Scale: 1:1,250

Printed at: 1:2,500

N W E S

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Surveyed 1953 Revised 1967 Edition N/A Copyright 1968 Levelled 1953	Surveyed 1965 Revised 1965 Edition N/A Copyright 1965 Levelled 1953

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Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: **1969**

Scale: 1:2,500

Printed at: 1:2,500

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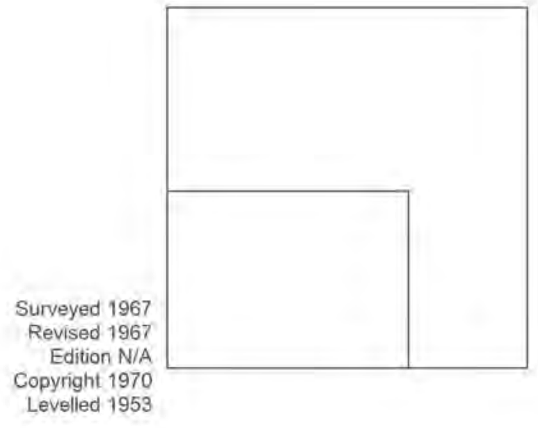

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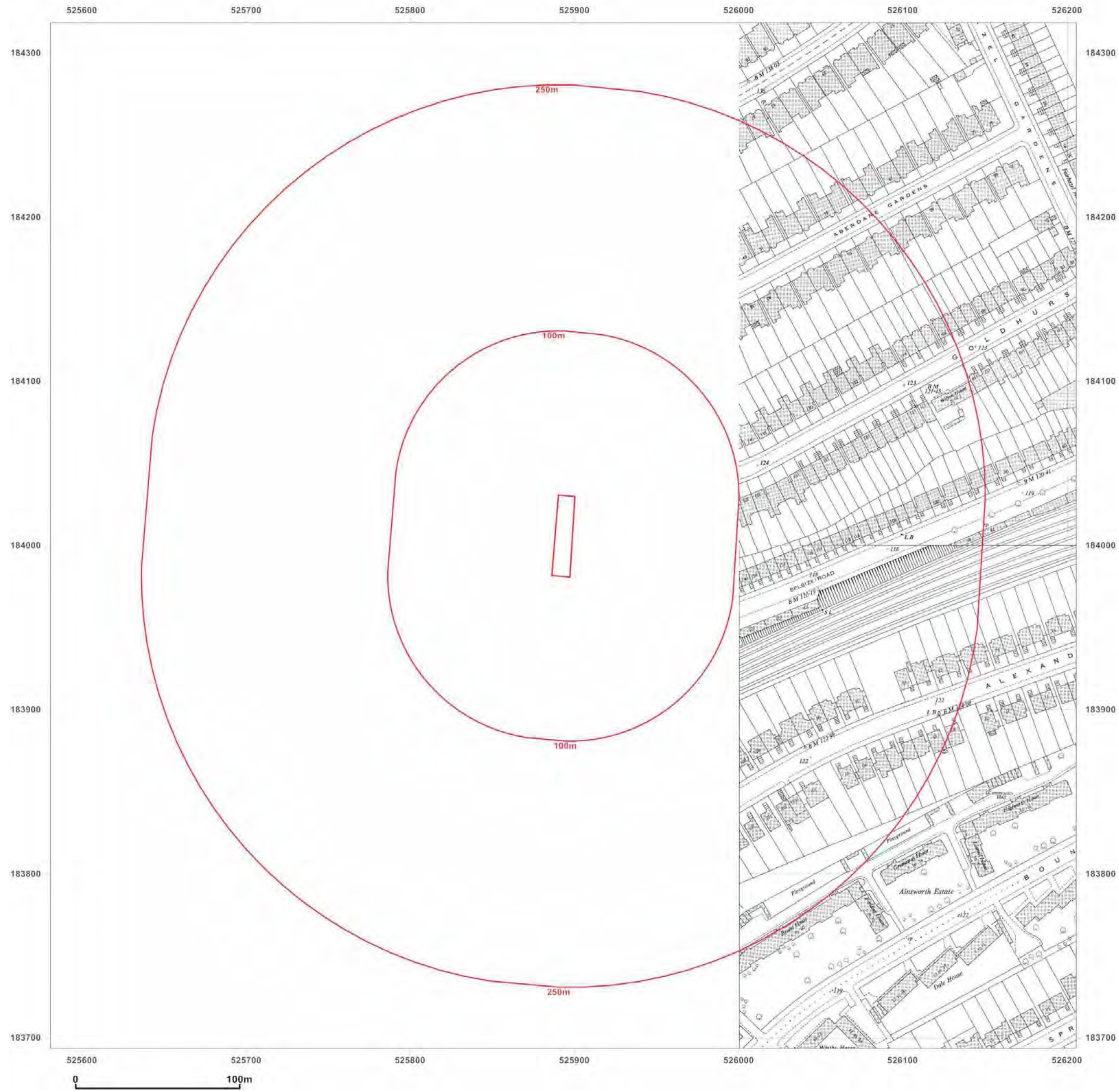

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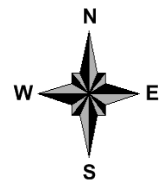
Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

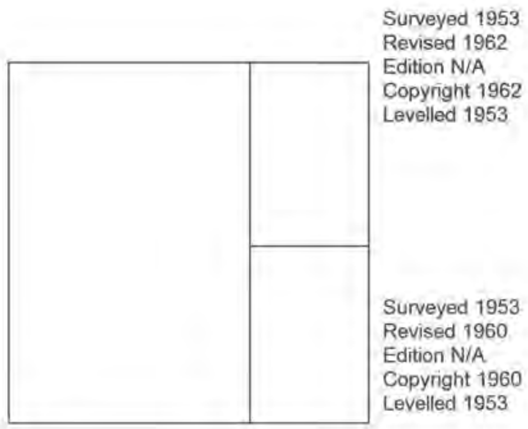
Map Name: National Grid

Map date: **1960-1962**

Scale: 1:1,250

Printed at: 1:2,500





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Grid Ref: 525893, 184006

Map Name: National Grid

Map date: 1955

Scale: 1:2,500

Printed at: 1:2,500

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Client Ref: 4873
Report Ref: CMAPS-CM-337906-4873-250614HIS
Grid Ref: 525893, 184006

Map Name: National Grid

Map date: **1953**

Scale: 1:1,250

Printed at: 1:2,500

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Surveyed 1953 Revised 1953 Edition N/A Copyright N/A Levelled 1953	Surveyed 1953 Revised 1953 Edition N/A Copyright N/A Levelled 1933

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