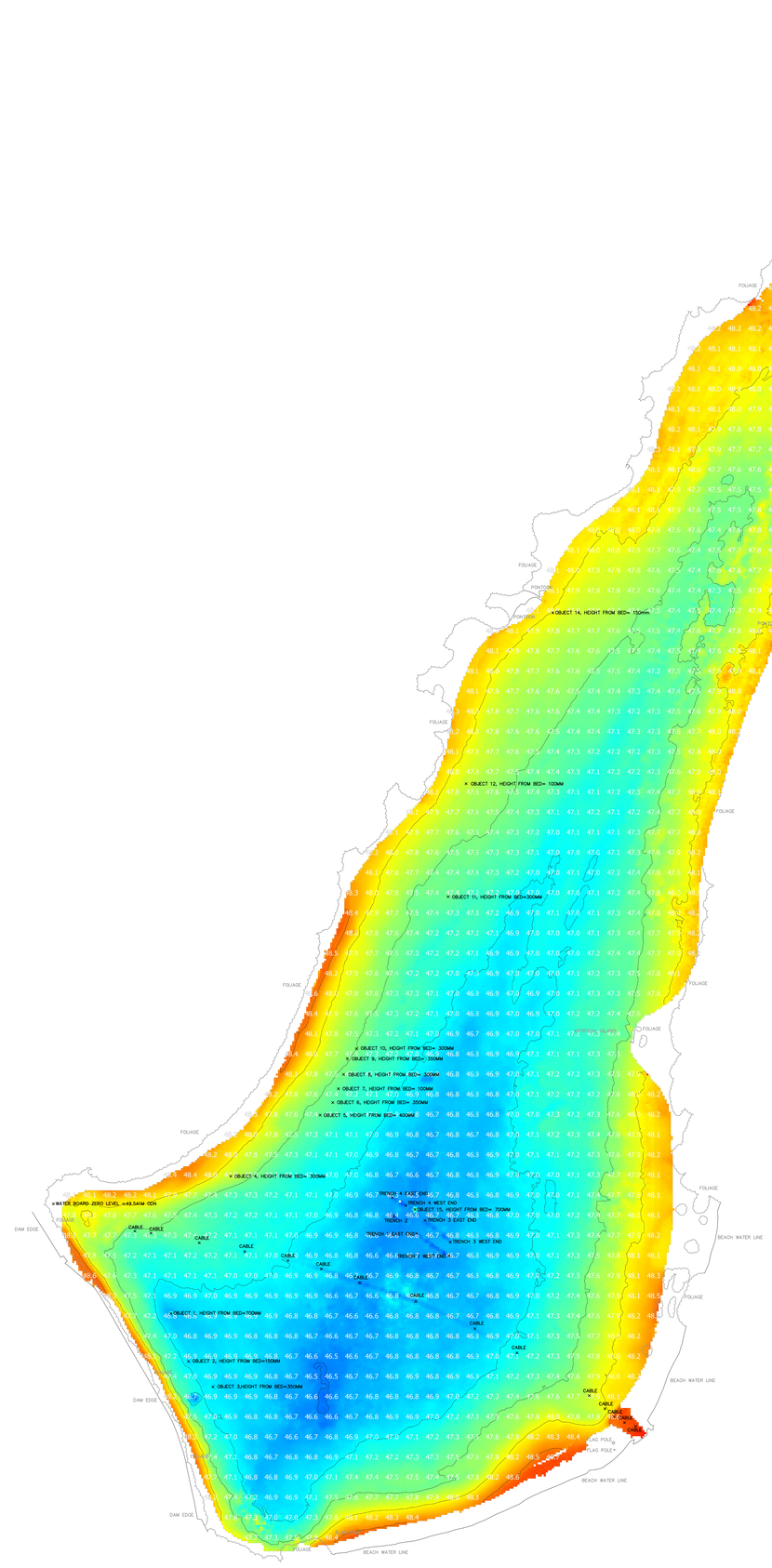


LandScope Engineering Ltd
The Chart House
Pickiescott
Church Stretton
Shropshire
SY6 6NT
01694 731930
enquiries@land-scope.com
www.land-scope.com
LandScopeUK
LandScope-Engineering

Bathymetric Survey

Ruislip Lido
Hillingdon, London

Sheet 1 of 2

Scale 1:1000 at A0

0 25 50 75 100
metres
Horizontal Datum: OS National Grid (OSTN15)
Vertical Datum: ODN (OSGM15)
Units: Metres

Survey Notes

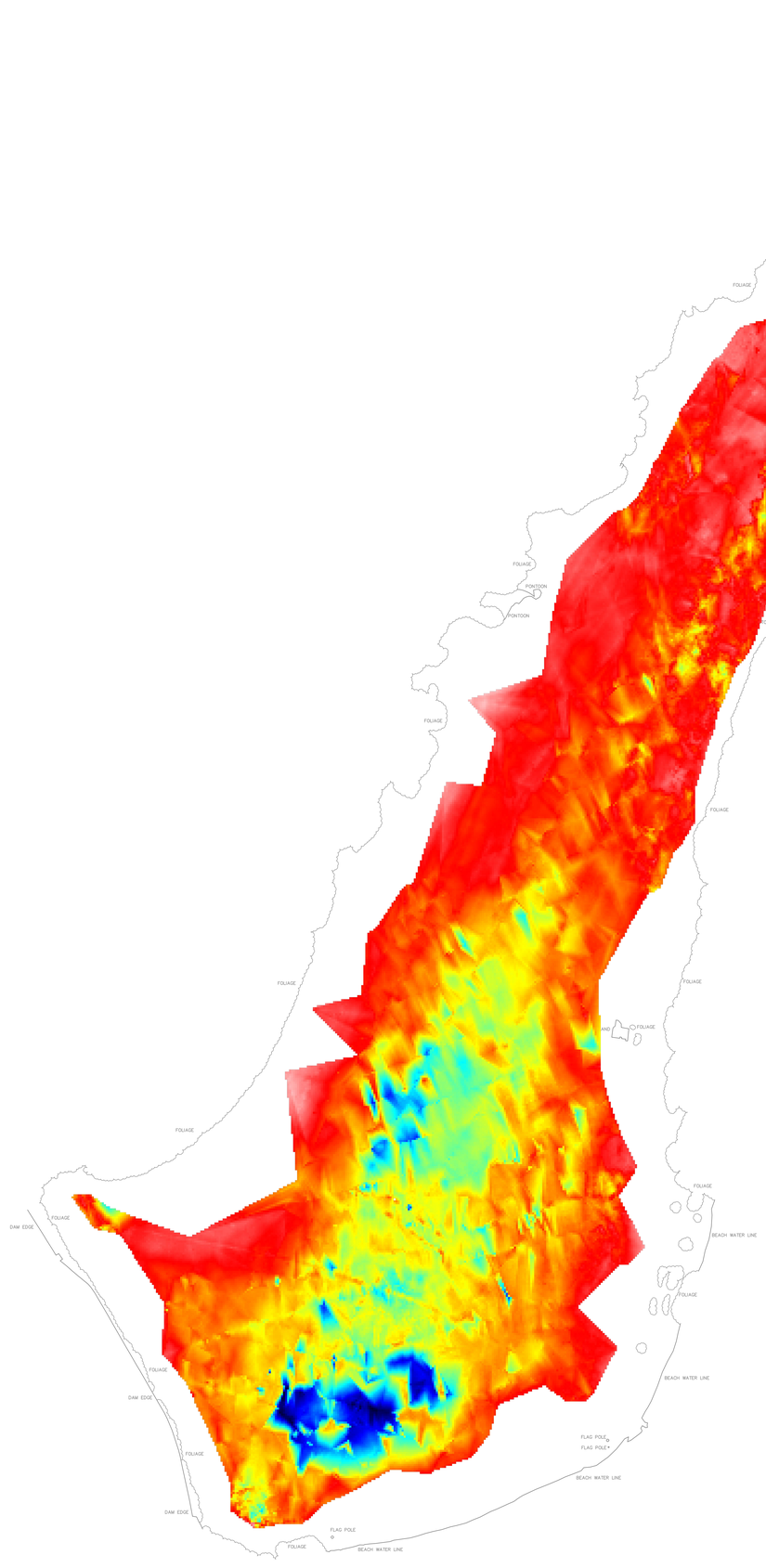
1. Multibeam bathymetry was acquired using a Norbit iWBMSe Narrow Transmit with integrated Applanix Surfmaster IMU. Positioning was achieved using dual Applanix 540AP antennas on a fixed baseline, employing VRS RTK corrections via Trimble VRSNow.
2. LiDAR data was acquired using a Norbit iLiDAR, positioned using the same system as the multibeam.
3. Shallow geophysical data was acquired using an Innomar Compact Sub-Bottom Profiler (SBP), positioned using a Trimble R10 GNSS receiver, employing VRS RTK corrections via Trimble VRSNow.
4. Spot heights were obtained using a Trimble R10 GNSS receiver, employing VRS RTK corrections via Trimble VRSNow.
5. Topographic detail was extracted from the LiDAR point cloud and is presented for contextual purposes only. As the vegetation often overhangs or is growing in the water, this is why some multibeam coverage extends beyond the line as drawn.
6. Coverage was achieved over all safely navigable areas; gently banking shallow areas around the periphery and some obstructions prevented bank to bank coverage with the multibeam. Coverage with the SBP was less than the multibeam, as it is only able to sample directly below the vessel, whereas the multibeam acquires a lateral swathe of data.
7. Presented sediment thickness was derived by picking hard bed returns in the SBP data as individual points; a TIN model was then used to create a 3D surface from the individual points, which could then be compared to the bathymetric surface, to give the presented thickness as the difference between the two. Note the hard bottom was masked by the water bottom multiple in the shallowest areas, limiting the areas where picks could be made, resulting in a further reduction in coverage to that explained above.
8. Potential obstructions and other areas of interest were identified from analysis of both the depth and backscatter components of the multibeam data

Legend

- Foliage Edge
- Water Line
- Contour 0.5m Interval
- × OBJECT 1, HEIGHT FROM BED= 700mm — Potential Obstruction
- ×CABLE — Submerged Cable
- × Trench 2 — Notably deeper areas adjacent potential obstruction
- × WATER BOARD ZERO LEVEL =49.54M ODN — Spot height for 0m mark on water level board

Prepared for: **Mace Group**
Survey Date: 01-03/02/2023

Drawing Reference	Rev	Date	Description	Filename	Drawn By	Field QC	Office QC	Approved By
3076-BS01-D01	01	22/3/2023	First Issue	3076-BS01-D01.dwg	JWi	JWi	KBu	KBu



LandScope Engineering Ltd
The Chart House
Pickiescott
Church Stretton
Shropshire
SY6 6NT
01694 731930
enquiries@land-scope.com
www.land-scope.com
LandScopeUK
LandScope-Engineering

Sediment Thickness

Ruislip Lido
Hillingdon, London

Sheet 2 of 2

Scale 1:1000 at A0

0 25 50 75 100
metres
Horizontal Datum: OS National Grid (OSTN15)
Vertical Datum: ODN (OSGM15)
Units: Metres

Survey Notes

1. Multibeam bathymetry was acquired using a Norbit iWBMSe Narrow Transmit with integrated Applanix Surfmaster IMU. Positioning was achieved using dual Applanix 540AP antennas on a fixed baseline, employing VRS RTK corrections via Trimble VRSNow.
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Legend

Foliage Edge

Water Line

Prepared for: **Mace Group**
Survey Date: 01-03/02/2023

Drawing Reference	Rev.	Date	Description	Filename	Drawn By	Field QC	Office QC	Approved By
3076-BS01-D01	01	22/3/2023	First issue	3076-BS01-D01.dwg	JWi	JWi	KBu	KBu

Appendix 13 – Ruislip Lido Preliminary Explosive Ordnance Risk Assessment (January 2025)

Stage 1 Preliminary Explosive Ordnance Risk Assessment

Project:	Ruislip Lido, Willow Lawn	**Client:**	Geo-Integrity
Doc Ref:	PRA.10229.25	**Issue Date:**	8th January 2025

Conclusion(s)		
GI works	There is a **potentially elevated** likelihood of explosive ordnance (EO) encounter during the proposed works.	
Post-GI Development	There is a **potentially elevated** likelihood of EO encounter during the proposed works.	
Recommendation(s)		
GI works	**Stage 2 Detailed Risk Assessment** to elucidate the risk.	To receive a Stage 2 DRA quotation: info@impartialassessments.com +44 (0) 207 126 8164
Post-GI Development	**Stage 2 Detailed Risk Assessment** to elucidate the risk.	

The Site

British National Grid Ref:
TQ 08726 89371

Site Address:
Reservoir Road
Ruislip Common
London Borough of Hillingdon
HA4 7TY

Note, the Ruislip Lido, Willow Lawn site will subsequently be referred to as the 'Site'.

Introduction

Introduction	A preliminary risk assessment (PRA) is the first stage of the UXO (unexploded ordnance) / EO (explosive ordnance) risk management process. It is a qualitative screening exercise to assess the likelihood of encountering EO during ground works at a given site. The assessment considers the basic factors that affect the likelihood of buried EO being present at a given site today and the likelihood it will be encountered during the proposed works.
Assessment methodology	This desktop risk assessment has been researched and written by a dedicated EO risk analyst and is produced in accordance with CIRIA C681 (2009) and C785 (2019) guidelines on UXO risk assessment. As such, the assessment considers the following five factors: ► Site location and Site history / occupancy ► Wartime UXO: German bombing, German shelling, and British and Allied anti-aircraft weaponry fire ► Domestic military activity: British and Allied armed forces activity during wartime and peacetime ► Mitigating Factors ► Extent of the proposed ground works Note, the likelihood of EO initiation / detonation and consequence(s) of EO initiation / detonation are assessed at Stage 2, not Stage 1. The numerical preliminary risk rating calculation included within this PRA is a unique Impartial Assessments Ltd (IAL) methodology that makes for a transparent and accountable risk assessment process.
Information sources	This assessment draws on preliminary research utilising information sources immediately available to IAL at the time of writing. The availability of historical information will differ depending on the Site's location. As an absolute minimum, all IAL Stage 1 PRAs involve analysis of recent aerial photography, historic OS mapping, original WW2 bombing density records and our PIEO (potential indicators of explosive ordnance) GIS map. The PIEO map plots our vast database of locations and incidents of interest.
Stage 1 objective	The main objective of a Stage 1 PRA is to confirm whether or not further research is required to verify the EO risk. If a low risk cannot be confirmed at Stage 1, a Stage 2 Detailed Risk Assessment (DRA) will be recommended.

The Site and Proposed Works

Current Site Occupancy		A post-WW2 constructed single-storey toilet block, soft landscaping, mature trees, and access road.
Historic Site occupancy (OS maps review)	Pre-WW1	Reservoir (water).
	Interwar / Pre-WW2	Reservoir bank and shallow water.
	Post-WW2 (1950s)	Reclaimed land adjacent to the reservoir by 1950.
Proposed Works		Redevelopment works involve the demolition and replacement of the existing toilet block, featuring a similar structural footprint. It is understood that piled foundations will be required, in addition to mechanical excavations. Prior to redevelopment a GI will be conducted, comprising a single cable percussive borehole to 15.0m bgl.

Enemy Action during WW1		
German Aerial Bombing	Did any bombs fall within 1km of the Site?	**No**
German Naval Shelling	Did any warship artillery shells fall within 1km of the Site?	**No**

Enemy Action during WW2			
German aerial bombing			
Indicator		Assessment	
Bombing Targets	Confirmed by the Luftwaffe	Original Luftwaffe target records identify RAF West Ruislip (a military storage depot and record office ~2.3km south of the Site) as the closest bombing target.	
	Unconfirmed secondary / opportunistic	None locally.	
Bombing Density	The Administrative Area	What bombing density was experienced by Ruislip & Northwood Urban District (within which the Site was located at the time)?	**Moderate bombing density** (38.3No. 'iron' bombs / 1,000 acres)
		Note, this is the official government bomb census figure. 'Iron' bomb refers to large (>40kg) thick-steel-cased bombs (most of which were high explosive filled). The bomb census did not report the numbers of small (1kg / 2kg) incendiary bombs (IBs), millions of which were dropped on the UK. It should also be noted that IAL's previous research has proven this record type inaccurate on a number of occasions.	
	The Study Area	What is the likelihood that the figure above (for the administrative area as a whole) accurately represents the immediate study area?	**Moderate**
		Note, the bombing density figure for a whole administrative area is not always a good indication of the bombing density at a given site. Within larger administrative areas, particularly rural districts, bombing density may be skewered by the presence of a single heavily bombed target, e.g. a military airfield.	
Air Raid Frequency		An original bomb census record of air raid locations throughout Greater London references 25No. raids affecting Ruislip.	
		Note, it should be noted that IAL's previous research has proven this record type inaccurate on a number of occasions.	
Bombing Decoy Sites		Were any British bombing decoy sites installed within 3km of the Site?	**No**
Bomb Damage		Has initial (partial) research located evidence of potential bomb damage (e.g. OS-mapped 'ruins', clearance, redevelopment) in the vicinity of the Site?	**No**
Bomb Strikes		Has initial (partial) research located evidence of a bomb strike(s) within 500m of the Site?	**Yes**
		Note, analysis of all Site-specific original bombing incident records is beyond the scope of a Stage 1 PRA. Some such records are unavailable within the time frame of a Stage 1 PRA.	

German land-based (French coast) artillery shelling	
Is the Site located within one of the areas of Kent that experienced cross-Channel artillery bombardment?	**No**

Domestic Military Activity

EO Contamination Source		Assessment	
Anti-Aircraft (AA) Artillery Fire	During WW1	Four static AA gun batteries were active within firing range of the Site and there is a low likelihood of mobile AA gun deployments to the wider study area.	
		The Site's westerly location combined with this small number of AA guns, likely resulted in an insignificant quantity of ammunition expended in the direction of the study area.	
		Note, many AA guns were mounted on vehicles so that they could be moved between vulnerable points. The number of active guns within firing range of a given site could therefore have been higher.	
	During WW2	12No. static heavy AA (HAA) gun batteries were positioned within firing range of the Site.	
		At least three sites within autocannon firing range of the Site were defended by light AA (LAA) guns.	
		No U.P. rocket projector (ZAA) batteries were positioned within firing range of the Site.	
		As German Luftwaffe activity in the region was frequent and intense, these guns probably expended a significant volume of ammunition.	
		Notes. Numerous LAA gun deployments (in defence of vulnerable points) were only temporary. During the early years of the conflict many static batteries were not armed due to a lack of available weapons. In the summer of 1944, there were large-scale inland deployments of LAA and HAA guns to parts of Kent, East Sussex and the Thames Estuary.	
Military Bases / Installations		Were / are there any British or Allied nation sites located within a significant distance of the Site?	**No**
Military Training Areas / Weapons Ranges		Were / are there any British or Allied nation sites located within a significant distance of the Site?	**No**
Munitions or Explosives Factories		Were / are there any such sites located within a significant distance of the Site?	**No**
Munitions Storage Depots		Were / are there any such sites located within a significant distance of the Site?	**No**
Wartime Requisition		What is the likelihood that the Site was requisitioned by the government for temporary military use?	During WW2, Rusilip Lido was requisitioned by the RAF for water survival training.
Defensive Measures and Fortifications		Did the Site occupy an area that was fortified against the anticipated German invasion of WW2 (or to a lesser extent, WW1)?	**No**
		Has initial research highlighted any fortifications or other defence measures within 1km of the Site?	**No**
		Could defensive minefields have been laid in the vicinity of the Stite during WW2?	**No**
		Could WW2 Home Guard (HG) soldiers of the local unit (either the 13th, 15th, 16th, or 17th Middlesex Battalions) conceivably have utilised the Site for any potentially significant activities?	**Unlikely**

Local EO Finds

Has evidence been found confirming or indicating an EO find(s) in the vicinity of the Site?	In February 2014, a UXO device was unearthed at Ruislip Lido by a member of the public. The specific type of device and its location were not reported, however Police officers described it as a 'World War Two bomb' '12-inches long and rocket shaped'. Although this could indicate several types of British or German UXO, it is most likely a German 1kg incendiary bomb, hundreds of thousands of which were dropped on Greater London during WW2.

Key Findings and Risk Factor Scoring

Likelihood of EO Contamination	German UXO	Is the study area known to have experienced or probably did experience an elevated WW1 and / or WW2 bombing density?	**Yes**
		Did the Luftwaffe earmark any targets within 3km of the Site for attack?	**Yes**
		Would the study area have been vulnerable to small-scale random / indiscriminate bombing? i.e. due to proximity of heavily bombed urban area or an individual / isolated primary target.	**Yes**
		Evidence of an officially abandoned unexploded bomb (UXB) in the vicinity?	**No**
		Has preliminary research identified evidence of bombing within 500m of the Site, direct evidence (e.g. recorded bomb strike) or indirect evidence (e.g. structural damage or bomb crater)?	**Yes**
		Did (or could) the Site boundary have encompassed risk elevating ground cover during WW1 and / or WW2?	**Yes**
		Could part(s) of the Site have been neglected / inaccessible during WW1 and / or WW2?	**Yes**
		Additional observations / considerations.	Preliminary (partial) research has confirmed three or four bomb strikes within 400m of the Site. Detailed research could highlight more. Any UXB strike to the open (shallow) water occupying part of the Site during WW2, could have been immediately lost beneath the waterline, leaving no trace of the incident.
	British / Allied EO	Was AA weapon ammunition expenditure significantly elevated within firing range of the Site during WW1 and / or WW2?	**Yes**
		Could an unexploded AA projectile strike have gone undetected / unreported on Site, due to risk elevating wartime occupancy / ground conditions?	**Yes**
		Has evidence of wartime or peacetime military activity affecting the Site been identified?	**Potentially**
		Does the Site's location / position / occupancy raise the possibility of temporary wartime military activity affecting the Site? e.g. invasion defences activity or military requisition.	**Yes**
		Could HG soldiers have intentionally buried / discarded live ammunition on Site during WW2?	**Potentially**
		Additional observations / considerations.	Recent EO finds highlight a historic culture in the armed forces of unauthorised small-scale disposal of unwanted hazardous items in bodies of water by individuals. The possibility that RAF or HG troops discarded ammunition in the shallow reservoir water of the Site during WW2 cannot be completed discounted.
			Scoring - Contamination Factor: **2**

Likelihood of EO Remaining	How many cycles of redevelopment have affected the area of the proposed ground works?	**Two**
	Does the Site currently contain any greenfield land or WW2-era brownfield land?	**No**
	Does undisturbed WW2-era soil / made ground / geology (that could be EO contaminated) remain at shallow depths (<2.0m bgl) on Site today?	**Unlikely**
	Does undisturbed WW2-era geology (that could be German UXB contaminated) remain at deeper depths (>2.0m bgl) on Site today?	**Yes**
	Has evidence been found confirming that the U.K armed forces have carried out EO clearance (EOC) activities on Site, recently or historically?	**No**
	If no evidence of EOC activity affecting the Site is immediately available, what is the likelihood that parts of the Site have been surveying / searched for EO by the U.K armed forces?	**Low**
	Scoring - Risk Mitigation Factor	**4**

Likelihood of Encounter	Will the proposed ground works disturb the zone of potential EO contamination (ZPC)?	**Yes**
	To what degree (volume of soil / geology) will the proposed ground works disturb the ZPC?	**Low**
	Are higher risk intrusive methodologies planned (e.g. boreholes, piling, vibro stone columns)?	**Yes**
	Will the / any proposed GI works disturb a significantly lower volume of the ZPC than the / any post-GI development ground works, or vice versa?	**No**
	Scoring - Proposed Works Factor (GI)	**2**
	Scoring - Proposed Works Factor (Post-GI Development)	**2**

Preliminary (Indicative) Risk Calculation

The preliminary risk rating calculation involves three factors:

- The likelihood of EO contamination (Site location and history)
- The likelihood of EO remaining on Site today (the extent of any risk mitigating factors)
- The likelihood of EO encounter during the proposed works (the type, volume and depth of proposed ground disturbance)

Each factor is numerically rated (**1 to 5**). For 'likelihood of EO contamination' and 'likelihood of EO encounter', **one** is the lowest likelihood.

For 'likelihood of EO remaining', **five** is the lowest degree of risk mitigative activities.

When added together, a final score of **eight or more** triggers the recommendation of a Stage 2 DRA.

Proposed Works	Contamination	Risk Mitigation	Proposed Works	Risk Rating Calculation	
	1 = lowest | 5 = highest	1 = highest | 5 = lowest	1 = lowest | 5 = highest		
GI works	2	4	2	2+4+2=	**8**
Post-GI Development	2	4	2	2+4+2=	**8**

Further research is required to educate the risk.

A Stage 2 Detailed EO Risk Assessment is recommended prior to all ground works commencing.

Impartial Assessments Ltd, 7 Bell Yard, Holborn, London, WC2A 2JR
+44 (0) 207 126 8164
www.impartialassessments.com
info@impartialassessments.com
Registered in England & Wales under Company Number: 13091178

Appendix 14 – Ruislip Lido Stage II Ground Investigation Survey (March 2025)

FINAL

Hillingdon London Borough Council

Phase II Factual and Interpretative Geo-Environmental Investigation Report

Willow Lawn and Woody Bay

Ruislip Lido

London Borough of Hillingdon

HA4 7TY

Report No: 24-12-14

March 2025

Geo-Integrity, 4 Church Street, Maids Moreton, Bucks. MK18 1QE

Landline: (01280) 816409 Mob.: 07858 367 125 Email:- info@geo-integrity.co.uk

DOCUMENT RECORD

Report Title	Phase II Factual and Interpretative Geo-environmental Investigation Report
Project Address	Willow Lawn and Woody Bay, Ruislip Lido, London Borough of Hillingdon, HA4 7TY
Project Number	24-12-14
Client Name	Hillingdon London Borough Council

Issue No Date	Status	Prepared by	Checked by
1 March 2025	Draft Report	Lee Ashworth B.Sc. M.Sc. F.G.S Engineering Geologist	Murray Bateman M.Sc. DIC C.Geol Pg. Cert. Director
		SIGNATURE 	SIGNATURE 
1 March 2025	Final Report	Lee Ashworth B.Sc. M.Sc. F.G.S Engineering Geologist	Murray Bateman M.Sc. DIC C.Geol Pg. Cert. Director
		SIGNATURE 	SIGNATURE 

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EXECUTIVE SUMMARY

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- Exploratory Hole Location Plan – Woody Bay
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- Cable Percussive Borehole Logs
- Trial Pit Logs

APPENDIX C – LABORATORY TESTING

- Geotechnical Testing
- Moisture Analysis – Woody Bay
- Geo-Environmental Testing – Willow Lawn
- Geo-Environmental Testing – Woody Bay
- HazWasteClassification Summary – Willow Lawn
- HazWasteClassification Summary – Willow Lawn

EXECUTIVE SUMMARY	
Site Location	Willow Lawn and Woody Bay, Ruislip Lido, HA4 7TY
OS Grid Reference	Willow Lawn is located at National Grid Reference 508720, 189375. Woody Bay is located at National Grid Reference 508894, 188885.
Development Proposals	The proposed development will include the demolition of the existing single-storey public toilets at Willow Lawn and Woody Bay followed by the construction of new single-storey public toilets.
Published Geology	Reference to the British Geological Survey website and Sheet 255; Beaconsfield indicates that the site is directly underlain by Superficial Deposits known as Alluvium, overlying Palaeocene bedrock known as the Lambeth Group. The Lambeth Group is underlain by Cretaceous bedrock known as the White Chalk Subgroup. The London Clay Formation which overlies the Lambeth Group is recorded 220m west of Willow Lawn and 20m east of Woody Bay.
Site History	Information obtained from historical maps and the desk study information indicates both sites remained undeveloped land adjacent to Ruislip Lido from 1865 to at least 1935. The sites were developed post 1935 with the construction of single storey public conveniences and again redeveloped in 2013 with the construction of public toilets. The sites have remained unchanged until present day.
Topography	The site and its surroundings are generally flat-lying.
Ground Conditions Encountered	**Ground Conditions Underlying Willow Lawn** • Underlain by Made Ground soils down to a depth of 0.60m bgl (as seen within TP1) • Underlain by the Lambeth Group down to depths in excess of 5.80m bgl. • The Lambeth Group comprised an upper soft to firm, silty, sandy clay down to a depth of 3.00m bgl proven to be low shrinkage in accordance with NHBC guidelines • This was underlain by very dense, orange, brown fine to medium sand, proven to be non-shrinkable • Given the very dense nature of the underlying sand the borehole was terminated at 5.80m bgl due to time constraints **Ground Conditions Underlying Woody Bay** • Underlain by Made Ground soils down to a depth of 0.90m bgl • Underlain by the Lambeth Group comprising soft to firm, becoming firm to stiff grey, orange silty clay with bands of orange silt with roots and rootlets down to a depth of 3.00m bgl • Underlain by very weak rock quality grey orange brown mudstone down to the base of the borehole in excess of 6.45m bgl • The material was proven to be medium to highly shrinkable in accordance with NHBC guidelines. However, given the hard nature of the material located below 3.00m bgl the in-situ conditions are unlikely to act as highly shrinkable cohesive soils, they are considered to act as a non-shrinkable very weak mudstone rock • There is evidence of moisture/volume unstable soils (i.e. desiccated soil) down to a depth of 3.00m bgl. As a result, foundations will need to extend to the underlying very weak mudstone below 3.00m bgl
Groundwater Encountered	Groundwater was not encountered in any of the exploratory holes down to depths in excess of 6.45m bgl.
Sulphate Attack on Underground Concrete	The following design sulphate class and aggressive chemical environment classification should be applied to the soils underlying both Woody Bay and Willow Lawn: **Made Ground:** DS-1/AC-1 **Lambeth Group:** DS-1/AC-1
Foundations	Both shallow and deep foundation options have been considered for the proposed developments at Willow Lawn and Woody Bay, see section 4.5 for further details.

Chemical Analysis	**<u>Willow Lawn – Geo-Environmental Risk Assessment</u>** Given the findings of the desk study, walkover survey, intrusive investigation and laboratory testing it is considered that there is a risk to end users from elevated levels of polyaromatic hydrocarbons identified within a single sample taken from Willow Lawn. See section 5.4 for further details. **Therefore, mitigations may be required should the proposed development include soft landscaping areas. However, should the proposed development comprise entirely of hardstanding no further mitigation measures will be required.** **<u>Woody Bay - Geo-Environmental Risk Assessment</u>** Given the findings of the desk study, walkover survey, intrusive investigation and laboratory testing it is considered that there is no elevated risk to end users from the proposed development. **Therefore, no additional human health risk assessment or mitigation measures are considered necessary as part of the proposed development at Woody Bay.**
Waste Soil Classification	**<u>Willow Lawn – Waste Soil Classification</u>** Currently, the waste soil on site is recommended to be classified as follows: - Made Ground (17 05 04) – Non-Hazardous - Natural Soil: (17 05 04) – Inert **<u>Woody Bay – Waste Soil Classification</u>** Currently, the waste soil on site is recommended to be classified as follows: - Made Ground (17 05 04) – Inert - Natural Soil: (17 05 04) – Inert
Recommendations	We recommend a watching brief should be undertaken during the construction phase, and if during development any previously undiscovered contamination (including visual or olfactory evidence) is found then site management should be immediately informed and inspection by a suitably qualified person should be undertaken.

This executive summary must be read in conjunction with this report and the Phase I Desk Study ref. 24-12-13

PHASE II FACTUAL AND INTERPRETATIVE GEO-ENVIRONMENTAL AND GEOTECHNICAL INVESTIGATION REPORT

1 FACTUAL

1.1 INTRODUCTION

Geo-Integrity Ltd were commissioned by the Client, Hillingdon Council, via three separate purchase orders to undertake a Phase II Geotechnical and Geo-Environmental Investigation Report at Woody Bay and Willow Lawn, Ruislip Lido, London Borough of Hillingdon, HA4 7TY.

Purchase Order No.:

- HC005969 dated 13/12/2024
- HC006673 dated 13/01/2025
- HC006569 dated 14/01/2025

This report describes the fieldwork and laboratory testing undertaken and provides an interpretative section of the geotechnical and geo-environmental data to inform the proposed development. This report should be read in conjunction with the previous Phase I Desk Study undertaken by Geo-Integrity with the reference 24-12-13, dated January 2025.

Willow Lawn is located at National Grid Reference 508720, 189375.

Woody Bay is located at National Grid Reference 508894, 188885.

This report will be reviewed by the Local Authority with reference to the NPPF. Once the development is completed, and as a minimum, the land must not be capable of being determined as ‘contaminated land’ under the terms of Part IIA of the Environmental Protection Act 1990. However, it also states that “Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.” As such, the previous desk study undertaken by Geo-Integrity ref. 24-12-13 constitutes the first stage in investigating whether the site is likely to be considered “contaminated”, in accordance with clause 196 of the NPPF, and should be read in conjunction with this Phase II interpretive report. The conclusion of the previous desk study confirmed the site is unlikely to be determined as ‘contaminated land’ under the terms Part IIA of the Environmental Protection Act 1990. However, it is considered that the site could be classified as being ‘affected by contamination’ and as such may not pass the test set out in clause 197.

Geo-Integrity, Mob.: - 07858 367 125 Email:- info@geo-integrity.co.uk

The objectives of this Phase II interpretative report are:

- Briefly summarise the site development proposals and site setting.
- To describe and report the fieldwork undertaken at the site.
- To describe and report the chemical laboratory work undertaken on selected samples.
- To provide an interpretation of the results of this investigation with regards to the geo-environmental implications for the site.
- To provide an interpretation of the results of the limited geotechnical testing undertaken.

The investigation was performed in accordance with the general requirements of BS 5930:2015, BS EN ISO 22475-1 (2006) and other relevant related standards. The fieldwork took place across three days between the 21st and 23rd of January 2025.

1.2 SOURCES OF INFORMATION

The following sources of information have been used to compile this report:

- Phase I Desk Study Report (ref. 24-12-13), undertaken by Geo-Integrity, dated January 2025.
- The British Geological Survey (BGS) and Environment Agency (EA) websites.
- A site reconnaissance visit undertaken on 17th of December 2024.
- Information from various internet sites on site history and environmental setting.

1.3 DEVELOPMENT PROPOSALS

The proposed development will include the demolition of the existing single-storey public toilets at Willow Lawn and Woody Bay followed by the construction of new single-storey public toilets.

Geo-Integrity, Mob.: - 07858 367 125 Email:- info@geo-integrity.co.uk

2 PHASE II INTRUSIVE INVESTIGATION

2.1 SITE WORK AND SAMPLING STRATEGY

The fieldwork was undertaken in accordance with BS 5930:2015, BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2006), with the exploratory locations being selected by Geo-Integrity and Hillingdon Borough Council following information from the development plans and the findings from the previous Phase I Desk study (Ref. 24-02-06. The exploratory hole locations can be seen in the Appendices. The site works were supervised by a UXO Engineer given the potential risk of EO identified during the desk study. A Stage 2 Detailed UXO Risk Assessment is currently being undertaken by Impartial Assessments which will inform the overall risk of EO and outline any mitigation measures required during the construction phase of the proposed development.

In addition, a buried 800mm high-pressure water main was identified by Hillingdon Council prior to the investigation situated immediately north of the proposed development at Willow Lawn. As such, Hillingdon Council refused permission to conduct a borehole investigation adjacent to the pipe. Therefore, BH1 was situated a suitable distance away, further south of the proposed development.

The fieldwork was undertaken across three days between the 21st and 23rd of January 2025 and consisted of two cut-down cable percussive boreholes and hand-dug trial pits.

Disturbed samples were taken at selected depths down to the base of the trial pits for subsequent laboratory testing and inspection, and the trial pits were backfilled upon completion.

Exploratory Hole	Location Reasoning
BH1 (Willow Lawn) **BH101 (Woody Bay)**	To log the ground conditions and collect near surface samples for geotechnical testing to aid foundation design
TP1, TP2 (Willow Lawn) **TP101, TP102 (Woody Bay)**	To log the near surface ground conditions and collect samples for chemical analysis given the findings of the previous desk study (ref. 24-12-13)

2.2 GROUND CONDITIONS UNDERLYING WILLOW LAWN

2.2.1 Summary

The site and laboratory test work revealed that the general succession of strata can be represented by Made Ground overlying the Lambeth Group. Descriptions of the strata encountered are given on

the exploratory hole records, and are summarised below. Further information is provided on the exploratory hole logs within the appendices.

2.2.2 Made Ground

Made Ground was encountered from ground level down to depths ranging between 0.60m and 1.50m bgl. The material was generally encountered as soft dark brown, silty, slightly gravelly clay, gravels being fine to coarse, sub-angular concrete, brick and tarmac with boulder size concrete.

2.2.3 Lambeth Group

The Lambeth Group was encountered in all exploratory holes from beneath the Made Ground from depths of 0.60m and 1.50m bgl down to the base of the borehole in excess of 5.80m bgl. The material was encountered as an upper soft to firm, brown, orange, grey, silty, slightly sandy clay with bands of orange and grey silt recorded down to a depth of 3.00m bgl. This was underlain by very dense orange, brown fine to medium sand.

Laboratory testing undertaken on representative cohesive samples revealed a moisture content ranging between 25% and 26% and a modified plasticity index ranging between 16% and 18% indicating a low shrinkage soil in accordance with NHBC guidelines.

Particle size distribution tests undertaken on representative granular soils recorded the following grain size percentages. Fines: - 5% - 7%; Sand: - 93% - 95%; Gravel: - 0%. The testing indicates the soil is predominantly a sand.

SPT tests undertaken within the upper cohesive soils recorded an ‘N’ value of 9, indicating a soft to firm cohesive soil.

SPT tests undertaken within the underlying granular soils recorded ‘N’ values ranging between 43 and 48. This indicates the underlying sand is very dense.

2.2.4 Groundwater

Groundwater was not encountered during the intrusive works down to the base of the borehole in excess of 5.80m bgl.

2.2.5 Sulphate Testing

Water soluble sulphate, pH tests acid soluble sulphate and total sulphur tests were carried out on one sample of Made Ground taken at a depth of 0.50m bgl, one sample recovered from the cohesive soils of the Lambeth Group at a depth of 2.00m bgl and one sample recovered from the granular soils of the Lambeth Group at a depth of 4.00m bgl. The results are presented in the table below:

Parameter	Range
Soluble Sulphate (mg/l)	62 - 83
pH Units	7.7 – 7.8
Acid Soluble Sulphate (%)	<0.01 – 0.04
Total Sulphur (%)	<0.01 – 0.04

2.2.6 Evidence of Contamination

There was no obvious contamination identified within the Made Ground or Natural Soils during the fieldwork, except for the aforementioned anthropogenic materials including brick, concrete, coal and tarmac within the Made Ground soils.

2.3 GROUND CONDITIONS UNDERLYING WOODY BAY

2.3.1 Summary

The site and laboratory test work revealed that the general succession of strata can be represented by Made Ground overlying the Lambeth Group. Descriptions of the strata encountered are given on the exploratory hole records, and are summarised below. Further information is provided on the exploratory hole logs within the appendices.

2.3.2 Made Ground

Made Ground was encountered from ground level down to depths ranging between 0.40m and 0.90m bgl. The material was generally encountered as loose, dark brown, sandy, gravelly silt, gravel is brick, tarmac and concrete.

2.3.3 Lambeth Group

The Lambeth Group was encountered in all exploratory holes from beneath the Made Ground from depths of 0.40m and 0.90m bgl down to the base of the borehole in excess of 6.45m bgl. The material was encountered as soft to firm, orange, silty clay with thin bands of orange silt with roots and rootlets

down to a proven depth of 1.50m bgl. This was underlain by very weak, grey, brown, orange mudstone down to the base of the borehole.

Laboratory testing undertaken on representative upper cohesive samples revealed a moisture content ranging between 20% and 26% and a modified plasticity index of 38% indicating a medium shrinkage soil in accordance with NHBC guidelines.

Laboratory testing undertaken on representative very weak mudstone samples revealed a moisture content ranging between 22% and 25% and a modified plasticity index ranging between 38% and 42% indicating a highly shrinkable soil. However, given the hard nature of this material located below 3.00m bgl the in-situ conditions are unlikely to act as highly shrinkable cohesive soil, they are considered to act as a non-shrinkable very weak mudstone rock.

SPT tests undertaken within the upper cohesive material recorded 'N' values ranging between 7 and 11. SPT tests undertaken within the underlying very weak mudstone below 3.00m bgl consistently recorded 'N' values of >50.

2.3.4 Groundwater

Groundwater was not encountered during the intrusive works down to the base of the borehole in excess of 6.45m bgl.

2.3.5 Sulphate Testing

Water soluble sulphate, pH tests, acid soluble sulphate and total sulphur tests were carried out on one sample of Made Ground taken at a depth of 0.50m bgl and one sample recovered from the cohesive soils of the Lambeth Group at a depth of 1.50m bgl. The results are presented in the table below:

Parameter	**Range**
Soluble Sulphate (mg/l)	62 - 83
pH Units	7.7 – 7.8
Acid Soluble Sulphate (%)	<0.01 – 0.04
Total Sulphur (%)	<0.01 – 0.04

2.3.6 Evidence of Contamination

There was no obvious contamination identified within the Made Ground or Natural Soils during the fieldwork, except for the aforementioned anthropogenic materials including brick, concrete, and tarmac within the Made Ground soils.

3 GEO-ENVIRONMENTAL TESTING

Geo-environmental laboratory testing was scheduled by Geo-Integrity on four Made Ground soil samples (two samples from Willow Lawn and two samples from Woody Bay) recovered during the fieldwork. The testing was carried out at a MCERTS and UKAS accredited laboratory. The results are presented in the Appendices.

Four soil samples were tested for a varied suite containing the following:

- Metals and Inorganic Substances
- Speciated Polyaromatic Hydrocarbons (PAH)
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX)
- Total Petroleum Hydrocarbons (TPH), with eight band split
- Asbestos Identification and Quantification

In addition, WAC tests were carried out on representative Made Ground soil samples taken from both Willow Lawn and Woody Bay to aid the waste classification of soils.

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4 GEOTECHNICAL INTERPRETIVE SECTION

4.1 GENERAL GROUND CONDITIONS WILLOW LAWN

The exploratory fieldwork undertaken during this investigation has identified the proposed development at Willow Lawn is underlain by Made Ground soils down to a depth of 0.60m bgl (as seen within TP1), underlain by the Lambeth Group down to depths in excess of 5.80m bgl. The Lambeth Group comprised an upper soft to firm, silty, sandy clay down to a depth of 3.00m bgl. Laboratory tests proved this cohesive material is of low shrinkability in accordance with NHBC guidelines. This was underlain by very dense, orange, brown fine to medium sand, proven to be non-shrinkable. Given the very dense nature of the underlying sand the borehole was terminated at 5.80m bgl due to time constraints.

Given the fact there are low shrinkage soils underlying the site associated with the Lambeth Group the guidelines within NHBC 'Building Near Trees' should be followed. The effects of any trees or hedgerows, within desiccation influencing the distance of the development (as described in the NHBC Standards, Chapter 4.2), should also be considered during design and construction. Where such vegetation is within the influence of new buildings, then foundations will need to extend to depths where soils are moisture/volume stable and appropriate precautionary foundation and floor slab design measures adopted in accordance with the NHBC Building Near Trees protocol. The laboratory testing undertaken indicates no significant evidence of desiccated soils underlying the proposed development at Willow Lawn.

Groundwater was not encountered down to the base of the borehole in excess of 5.80m bgl.

4.2 GENERAL GROUND CONDITIONS WOODY BAY

The exploratory fieldwork undertaken during this investigation has identified the proposed development at Woody Bay is underlain by Made Ground soils down to a depth of 0.90m bgl, underlain by the Lambeth Group. The Lambeth Group comprised soft to firm, becoming firm to stiff grey, orange silty clay with bands of orange silt with roots and rootlets down to a depth of 3.00m bgl down to a depth of 3.00m bgl. This was underlain by very weak, rock-quality, grey, orange brown mudstone down to the base of the borehole in excess of 6.45m bgl. Laboratory tests proved the Lambeth Group to be medium to high shrinkage in accordance with NHBC guidelines. However, given the hard nature of the material located below 3.00m bgl the in-situ conditions are unlikely to act as highly shrinkable cohesive soils, they are considered to act as a non-shrinkable very weak mudstone rock.

Given the fact there are medium to high shrinkage soils underlying the site associated with the Lambeth Group and the proximity to an adjacent wooded area the guidelines within NHBC 'Building Near Trees' should be followed. The effects of any trees or hedgerows, within desiccation influencing the distance of the development (as described in the NHBC Standards, Chapter 4.2), should also be considered during design and construction. Where such vegetation is within the influence of new buildings, then foundations will need to extend to depths where soils are moisture/volume stable and appropriate precautionary foundation and floor slab design measures adopted in accordance with the NHBC Building Near Trees protocol. The laboratory results indicate evidence of desiccated soils, see section 3.3 for further details.

Groundwater was not encountered down to the base of the borehole in excess of 6.45m bgl.

4.3 POTENTIAL DESICCATED SOILS UNDERLYING WOODY BAY

The walkover survey and desk study information identified the proposed development at Woody Bay is located within close proximity to mature trees. In addition, the underlying soils have been proven to comprise medium to highly shrinkable soils down to 3.00m bgl underlain by non-shrinkable very weak mudstone. Therefore, as medium to high shrinkage cohesive soils have been encountered underlying the site, an assessment of desiccated soils has been undertaken based on the moisture contents and index properties measured from the laboratory testing. Samples were taken from 1m intervals within BH101 and tested for its moisture content and Atterberg limits.

Firstly, all the samples have been weighed before and after oven drying to measure the gravimetric moisture content. Equivalent moistures, factored to take account of the "% passing" value, have been used throughout. The line of the equivalent Mc has been superimposed against depth. The graphs are attached. Moisture content in a uniform soil should display a generally linear relationship, decreasing gradually with depth as natural in-situ earth pressures increase. If there is a negative bulge, this indicates a zone of desiccation. As can be seen on this site (Woody Bay) the MC profile displays a slight negative bulge at a depth of 2.00m bgl. However, this is considered to be influenced by the change in strata from cohesive soils to rock quality strata below 3.00m bgl.

The second method used as part of this assessment was first proposed by Richard Driscoll (Driscoll R. (1983) "Influence of Vegetation on Clay Soils" Geotechnique. Vol. 33). The method seeks to establish a relationship between the moisture content and index properties of the soil. Driscoll suggested that soil might be desiccated if the moisture content is less than (a) 0.4 x LL or (b) 2% + PL. Driscoll preferred the LL test as the more reliable of the two and recommends this assessment

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is always used in conjunction with other forms of testing. In addition, if the soil is highly desiccated the tests perform better and become less clear and confusing as the level of desiccation diminishes, as stated by Plante, S., Rollit, E. and Nazareth, C. (2007) “Site Investigation and Soil Testing” The Clay Research Group, Pg. 18.

The laboratory tests indicate equivalent moisture contents are marginally below the PL+2% and LL*0.4 throughout the soil profile. However, the equivalent moisture content is significantly lower than the index properties at a depth of 2.00m bgl. Therefore, there is some evidence the cohesive soils are desiccated above 3.00m bgl. The equivalent moisture contents are also marginally less than the index properties within the samples recovered from the underlying very weak mudstone. It is considered this material is over-consolidated from previous over-burden pressures which has likely removed pore waters and therefore not considered desiccated as a result of tree root action.

From the above assessments it is considered there is evidence of moisture/volume unstable soils down to a depth of 3.00m bgl. As a result, foundations will needs to extend to the underlying very weak non-shrinkable mudstone below 3.00m bgl.

4.4 EXCAVATIONS

Conventional plant should be sufficient for the excavation of the underlying soils at the site. The hand-dug trial pits and boreholes generally remained open with no records of collapse. However, granular soils were encountered at a depth of 3.00m bgl underlying Willow Lawn which could be unstable in the short term.

Shoring should be made available for excavations, and it is important to remember that entry into excavations is strictly prohibited without it.

Excavations are likely to remain dry down to depths in excess of 5.00m bgl.

Existing foundations will need grubbing out during the construction phase.

4.5 FOUNDATIONS

The proposed development at both Willow Lawn and Woody Bay will include the replacement of the existing single storey public toilets, matching the footprint of the previous structure.

Shallow foundations are considered viable for both sites given the underlying ground conditions and assumed low bearing structure. However, given the evidence of moisture/volume unstable soils down to a proven depth of 3.00m bgl underlying the proposed development at Woody Bay shallow

foundations will need to extend to the very weak mudstone below 3.00m bgl. As such, deeper foundations may be a suitable alternative and are also considered below. The maximum depth achieved during this intrusive investigation was 6.45m bgl due to the very dense/hard nature of the underlying soils. Should deeper foundations be the chosen method, a piling contractor may request a deeper borehole.

4.5.1 Shallow Foundations Underlying Willow Lawn

4.5.1.1 Shallow Strip Foundations – Willow Lawn

The Made Ground is considered unsuitable as a bearing stratum due to its variability, and potential for unacceptable total and differential settlement under applied foundation loadings.

The underlying Lambeth Group at a depth of 1.00m bgl or 0.20m into the stratum, whichever is the deeper, may be suitable for conventional shallow foundations. At this depth, an estimation of the net allowable bearing pressure is considered to be 100kPa which could be adopted for foundations not exceeding 1m in width. This allows for a factor of safety of three against shear failure and for settlements generally not to exceed 25mm taking place over a number of years.

It is recommended foundations a suitably reinforced to combat differential settlement given the variable nature of the Lambeth Group.

4.5.1.2 Shallow Raft Foundations – Willow Lawn

As an alternative to strip foundations, it may be possible to construct a raft foundation given the size of the building and the low working load likely required. This raft should be designed in general accord with chapter 4.4 of the NHBC standards.

The advice of specialist should be sought to formulate a suitable design and implementation technique for the ground conditions encountered at this site before commencement of the works. The following comments regarding the raft design are therefore for general guidance only.

Assuming the above is implemented, it is considered the underlying natural soils at a depth of 0.75m bgl or 0.20m into the stratum, whichever is the deeper, with a suitably reinforced raft formed of 3m-by-3m sections could be sufficient to provide an allowable bearing pressure of 70kN/m^2.

4.5.2 Shallow Foundations Underlying Woody Bay

4.5.2.1 Shallow Strip Foundations – Woody Bay

The Made Ground is considered unsuitable as a bearing stratum due to its variability, and potential for unacceptable total and differential settlement under applied foundation loadings.

The underlying cohesive soils of the Lambeth Group down to a depth of 3.00m bgl are also considered unsuitable as a bearing stratum due to the evidence of desiccated soils likely impacted by tree root action.

The underlying very weak mudstone at a depth of 3.00m bgl or 0.20m into the stratum whichever is the deeper, may be suitable for conventional shallow strip foundations. At this depth, an estimation of the net allowable bearing pressure is considered to be 250kPa which could be adopted for foundations not exceeding 1m in width. This allows for a factor of safety of three against shear failure and for settlements generally not to exceed 25mm taking place over a number of years.

It is recommended foundations a suitably reinforced to combat differential settlement given the variable nature of the Lambeth Group.

4.5.2.2 Raft Foundations – Woody Bay

Given the significant thickness of the desiccated soils (proven down to a maximum depth of 3.00m bgl) raft foundations are not considered a viable option as a significant amount of material (3m deep) would need to be removed and replaced with compacted granular fill.

4.6 PILED FOUNDATIONS

Should foundations require deepening, a mini-piled foundation design may be a suitable alternative to shallow foundations.

4.6.1 Mini-Piled Foundations – Willow Lawn

Piles would extend through the Made Ground soils, and the cohesive soils of the Lambeth Group and terminate within the underlying very dense granular soils of the Lambeth Group.

The advice of specialist piling contractors should be sought to formulate a suitable piling technique and type for the ground conditions encountered at this site, before commencement of the works. The following comments regarding pile design are therefore for general guidance only.

It is anticipated that a bored, cast in situ or driven pile systems are appropriate on this site given the ground conditions. **Consideration will need to be given as the vibrations from driven piles could negatively impact adjacent structures including the known buried 800mm high-pressure water main adjacent to the proposed development at Willow Lawn**. Volumes of concrete must be accurately measured as necking may occur.

The working loads below are an estimation based on bored piles, and have been based entirely on the base resistance of the very dense sands below 3.00m bgl. The skin resistance from the Made Ground Lambeth Group were removed as part of the calculations. An overall FoS of 3 has been applied.

Depth of pile (m bgl)	**Assumed founding stratum**	**Working load (kN) for piles of the following diameters**	
		Pile diameter 300 mm	**Pile diameter 450 mm**
4.00	Very Dense Sand (Lambeth Group)	150	350

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4.6.2 Mini-Piled Foundations – Woody Bay

Piles would extend through the Made Ground soils, and the desiccated medium to high shrinkage cohesive soils of the Lambeth Group (proven down to a maximum depth of 3.00m bgl) and terminate within the underlying very weak, non-shrinkable mudstone of the Lambeth Group.

The advice of specialist piling contractors should be sought to formulate a suitable piling technique and type for the ground conditions encountered at this site, before commencement of the works. The following comments regarding pile design are therefore for general guidance only.

It is anticipated that a bored, cast in situ or driven pile systems are appropriate on this site given the ground conditions. Consideration will need to be given as the vibrations from driven piles could negatively impact adjacent structures. Volumes of concrete must be accurately measured as necking may occur.

The working loads below are an estimation based on bored piles, and have been based entirely on the skin friction of the Lambeth Group below 3.00m bgl and the base resistance of the very weak mudstone at a depth of 5.00m bgl. The skin resistance from the Made Ground and the desiccated soils of the Lambeth Group were removed as part of the calculations. An overall FoS of 3 has been applied.

Depth of pile (m bgl)	**Assumed founding stratum**	**Working load (kN) for piles of the following diameters**	
		Pile diameter 300 mm	**Pile diameter 450 mm**
5.00	Very Weak Mudstone (Lambeth Group)	150	250

4.7 SULPHATE ATTACK ON UNDERGROUND CONCRETE

4.7.1 Willow Lawn

Water soluble sulphate, pH tests acid soluble sulphate and total sulphur tests were carried out on one sample of Made Ground, one sample recovered from the cohesive soils of the Lambeth Group and one sample recovered from the granular soils of the Lambeth Group at a depth of 4.00m bgl to determine the design sulphate class.

In accordance with the BRE Special Digest, these results have been given in the table below, in relation to strata type and required Design Sulphate Class and site Aggressive Chemical Environment Classification (ACEC)**.**

Strata	Design Sulphate Class	Aggressive Chemical Environment Classification
Made Ground	DS-1	AC-1
Lambeth Group (Cohesive)	DS-1	AC-1
Lambeth Group (Granular)	DS-1	AC-1

The recommendations given in the above digest, with respect to suitable concrete design and other associated precautions against sulphate attack, should be followed for all below-ground-level concrete.

4.7.2 Woody Bay

Water soluble sulphate, pH tests acid soluble sulphate and total sulphur tests were carried out on one sample of Made Ground and one sample recovered from the Lambeth Group to determine the design sulphate class.

In accordance with the BRE Special Digest, these results have been given in the table below, in relation to strata type and required Design Sulphate Class and site Aggressive Chemical Environment Classification (ACEC)**.**

Strata	Design Sulphate Class	Aggressive Chemical Environment Classification
Made Ground	DS-1	AC-1
Lambeth Group	DS-1	AC-1

The recommendations given in the above digest, with respect to suitable concrete design and other associated precautions against sulphate attack, should be followed for all below-ground-level concrete.

5 GEO-ENVIRONMENTAL INTERPRETATION

5.1 RISKS TO HUMAN HEALTH

5.1.1 Introduction

Environment Agency guidance LCRM "Land Contamination Risk Management" 2020 states that human health risk assessment should be undertaken by a tiered approach using the source-pathway-receptor principle. A desk study constitutes the first tier and this has been previously undertaken by Geo-Integrity, dated January 2025, ref. 24-12-13, and should be read in conjunction with this report. The conceptual site model is referenced below:

Reference to the information gathered within this desk study and walkover survey indicates both sites remained undeveloped land adjacent to Ruislip Lido from 1865 to at least 1935. The sites were developed post 1935 with the construction of single storey public conveniences and later redeveloped in 2013 with the demolition of the public conveniences and construction of single storey timber-frame public toilets. The sites have remained unchanged until present day.

No significant sources of contamination were recorded from the desk study information on either site. However, given the sites have experienced phases of development it is considered possible Made Ground soils may be present which may contain elevated levels of contaminants given the unknown origin of such soils.

The walkover survey recorded a single potential source of contamination associated with an above ground diesel tank located off-site to the north of Willow Lawn associated with the adjacent miniature railway.

Therefore, it is considered the primary potential sources of contamination on site: -

- *Made Ground soils associated with the phases of development*
- *Accidental spillages and leaks of hydrocarbons from the off-site above ground oil tank adjacent to Willow Lawn*

Therefore, further intrusive investigation is recommended at the site prior to any development/redevelopment, and currently, it is considered that the following potential source/pathway/receptors may be present at and around the site:

Potential Source	Potential Pathway	Potential Receptor	Considered Risk
Made Ground associated with the phases of development at both Willow Lawn and Woody Bay	*Ingestion, inhalation or absorption from direct contact with soil*	*End Users*	*Low Risk*
	Leaching through the ground	*Controlled Waters*	*Low Risk*
	Possible contact during work phase	*Construction Workers*	*Low Risk*
	Possible contact	*Underground Services*	*Low Risk*
Hydrocarbons from the off-site above ground diesel tank adjacent to Willow Lawn	*Ingestion, inhalation or absorption from direct contact with soil*	*End Users*	*Low Risk*
	Leaching through the ground	*Controlled Waters*	*Low Risk*
	Possible contact during work phase	*Construction Workers*	*Low Risk*
	Possible contact	*Underground Services*	*Low Risk*

Therefore, it was considered that potential source/pathway/receptors are present at the site, and as part of this investigation a sampling strategy, outlined in section 2.1, was used to undertake confirmatory chemical testing at the site.

Four near surface representative Made Ground samples taken from Willow Lawn and Woody Bay were tested for chemical suites that were also analysed under the second tier, known as a Generic Quantitative Risk Assessment (GQRA), which uses generic guideline values to compare site chemical data against. The next and final tier would be a Detailed Quantitative Risk Assessment (DQRA), which uses data derived from the ground investigation to assess risks to identified receptors.

The assessment included in this report comprises a GQRA, which is undertaken by comparing soil contaminant concentrations from this investigation with conservative Generic Assessment Criteria (GAC). GAC for various land use and exposure scenarios have been selected from the following sources:

- CL:AIRE Category 4 Screening Levels (C4SL);
- LQM Suitable for Use Levels (S4UL);

- CL:AIRE/EIC/AGS GAC

The GAC have been derived using the Environment Agency Contaminated Land Exposure Assessment (CLEA) model, for a range of land uses and exposure scenarios, including:

- Residential with the consumption of home-grown produce
- Residential without the consumption of home-grown produce
- Commercial
- Allotments
- Public Open Space near residential housing (POS_{resi})
- Public Open Space public park scenario (POS_{park})

Given the proposed development is to replace the existing toilet blocks at Willow Lawn and Woody Bay a “Public Open Space near a public park scenario (POS_{park})” has been selected for this assessment.

5.2 RESULTS OF CHEMICAL TESTING

Two representative Made Ground soil samples were tested from Willow Lawn including:

- TP1 at a depth of 0.50m bgl
- TP2 at a depth of 0.30m bgl

Two representative Made Ground soil samples were tested from Woody Bay including:

- TP101 at a depth of 0.00m to 0.50m bgl
- TP102 at a depth of 0.00m to 0.60m bgl

Of the soil samples screened against the relevant GAC for a “Public Open Space near a public park scenario (POS_{park})” land use scenario, retrieved from Woody Bay as described above, none of the determinants exceeded the relevant levels.

However, of the soil samples screened against the relevant GAC for a “Public Open Space near a public park scenario (POS_{park})” land use scenario, retrieved from Willow Lawn as described above, one of the two samples recorded elevated levels of three polyaromatic hydrocarbons including benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene.

None of the samples tested identified Asbestos Containing Material (ACM).

5.2.1 Polyaromatic Hydrocarbons

Elevated levels of three polyaromatic hydrocarbons were recorded within one Made Ground sample taken from TP2 (Willow Lawn) at a depth of 0.30m. The follow elevated concentrations were recorded:

- Benzo(b)fluoranthene recorded at 48mg/kg, the relevant GAC is 13mg/kg
- Benzo(a)pyrene recorded at 34mg/kg, the relevant GAC is 11mg/kg
- Dibenz(a,h)anthracene recorded at 6mg/kg, the relevant GAC is 1.1mg/kg

5.3 RISK TO END USERS – WOODY BAY

Given the results of the desk study, intrusive investigation and laboratory testing, no source-pathway-receptor linkage has been identified at the site and consequently **no additional human health risk assessment or mitigation measures are considered necessary as part of the proposed development at Woody Bay.**

These conclusions should be confirmed by the relevant Regulatory Authority as soon as possible prior to development.

5.4 RISK TO END USERS – WILLOW LAWN

Given the results of the desk study, intrusive investigation and laboratory testing elevated levels of polyaromatic hydrocarbons were encountered within the near surface Made Ground soils. It is considered the adjacent miniature railway activities are likely to have contributed to the elevations of polyaromatic hydrocarbons. Combustion engines and various other burning of fuels likely being the most likely source of polyaromatic hydrocarbons.

The proposed development is to replace the existing toilet block with the new footprint matching that of the existing block. As such, it is considered there will be limited, if at all any, areas of soft landscaping within the proposed development area. Any areas of hardstanding including the footprint of the building will form a barrier between the impacted Made Ground soils and the End Users. Therefore, should the proposed development comprise entirely of hardstanding then no further mitigation measures will be required.

However, should the proposed development at Willow Lawn include areas of soft landscaping mitigation measures will be required.

These conclusions should be confirmed by the relevant Regulatory Authority as soon as possible prior to development.

6 REDUCING THE RISK TO END USERS – WILLOW LAWN

6.1.1 Clean Cover Layer

To break the exposure pathways to site users, it is considered that the pathway between the impacted Made Ground soils and the end users needs to be broken.

As such a cover system could be engineered within areas of soft landscaping. It is considered that any disturbance or intermixing of soils is unlikely to exceed 600mm depth from earthworm activity, double digging and root depth as stated in “Cover Systems for Land Regeneration" prepared by RSK ENSR Ltd. Therefore, a cover system would require a 600mm layer of clean cover, consisting of at least 150mm of topsoil 450mm of clean imported clay and a geotextile dig barrier at the base**. This cover system is not required in areas of hardstanding (driveways, paving areas and under the building), where this will break the pathway between contaminated soils and site users**.

During the development, it is recommended that this process of placing the cover layer is tightly monitored and recorded (soil tests, photographs, depth measurements etc) as a verification report will be required to prove its existence to Local Authorities or financing organisations (mortgage companies etc).

6.2 REDUCING THE RISK TO CONSTRUCTION WORKERS

To reduce the risk to as low as reasonably practicable for the construction workers it is recommended that high standards of personal hygiene should be maintained amongst the site personnel at all times. All personnel coming into contact with the soil, ground workers in particular, should be instructed to use gloves when on site to avoid dermal contact and restrict inadvertent hand-to-mouth ingestion. Washing facilities should be provided for the site staff to use and should be used prior to eating or smoking. Reference should be made to the HSE Document, “Protection of Workers and the General Public during Development of Contaminated Land”.

It is also recommended that a watching brief for undiscovered contamination is included in the Works Method Statement. Given the long human history of the site, it is always possible that some previous undiscovered contamination may be encountered. If this is the case, the area should be isolated, and contact be made to a suitably qualified professional for further advice. This is particularly important if the contamination is possibly ACM or liquid based.

6.3 POST REMEDIATION VERIFICATION – WILLOW LAWN

Any remedial measures undertaken at the site will require independent verification once completed to satisfy the relevant regulatory authorities and other interested parties, including future owners of the site, banks, insurers, and mortgage companies. This usually involves a small validation investigation to confirm that the recommended work has been successful.

6.4 RISK TO CONTROLLED WATERS

None of the metal and inorganic contaminants tested for within the total soil chemical tests recorded significantly elevated values when compared to the relevant GAC for Human Health. In addition, the eluate analysis undertaken as part of the WAC testing on representative Made Ground samples from both Willow Lawn and Woody Bay recorded significantly low levels with the majority being below detectable limits for a range of heavy metals, BTEX, PCBs and mineral oil indicating the Made Ground soils are not capable of leaching harmful amounts of contaminants into nearby Controlled Waters. Elevated levels of polyaromatic hydrocarbons were encountered within a single sample recovered from Willow Lawn. However, polyaromatic hydrocarbons are generally insoluble in water which limits their mobility within the environment. Therefore, it is considered that there is no elevated risk of Controlled Waters pollution from the proposed development.

The Environment Agency is the regulatory body charged with protection of controlled waters and may be a consultee in the planning process. We recommend that the conclusions of this report are agreed with the relevant Local Authority at the earliest stage, to reduce any potential delays.

6.5 RISK TO UNDERGROUND WATER SUPPLY PIPES

Based upon the guidance document from the UK Water Industry Research (UK WIR), 'Contaminated Land Assessment Guidance' February 2014, and the results of the samples tested from the site it is considered that conventional PE water pipes are suitable on this site as no elevated levels of hydrocarbons or BTEX were recorded. This should be confirmed with the local water company as not all authorities use this guidance.

7 WASTE DISPOSAL CLASSIFICATION

7.1 INTRODUCTION

Excavation for foundations or services will produce waste soil and possibly other waste streams. As a waste producer you have a duty of care under section 34 of the Environmental Protection Act 1990 to ensure, amongst other things that these wastes are:

- Correctly stored
- Correctly classify
- Handed only to an authorised person
- Disposed of properly.

To aid with these obligations we have used HazWasteOnline to undertake the Hazard Assessment Screen as part of this investigation, to establish whether the sampled soils should be considered as either hazardous or non-hazardous waste. This classification process is in line with the Environment Agency's guidance WM3 "Guidance on the classification and assessment of waste", Version 1.2, October 2021.

7.2 RESULTS OF HAZARD ASSESSMENT

The full results of the HazWasteOnline Stage-One analyses can be seen in the Appendices.

The HazWasteOnline classification summary sheet from this investigation provides a waste classification of Non-Hazardous waste for all samples tested at both Willow Lawn and Woody Bay

No visible pieces of asbestos were detected (by the naked eye) in any of the exploratory holes, or identified in the chemical testing. Therefore, asbestos was not considered further from a waste perspective.

7.3 WASTE ACCEPTANCE CRITERIA (WAC) TESTING RESULTS

To further classify the waste soil for landfill disposal, Waste Acceptance Criteria (WAC) testing has been carried out on one representative Made Ground sample from both Willow Lawn (TP1 at a depth of 0.50m bgl) and Woody Bay (TP102 at a depth of 0m to 0.60m bgl).

7.3.1 WAC Results – Willow Lawn

The results show that the soil sample taken from the Made Ground at Willow Lawn soil fails the Inert Waste criteria due to elevated levels of total polyaromatic hydrocarbons and elevated total organic

carbon (TOC). Therefore, the Made Ground soils underlying Willow Lawn should be classified as Non-Hazardous. The laboratory testing results are presented in the Appendices.

It is considered that the underlying natural soils beneath the site qualify in accordance with EU Council Decision 2003/33/EC para. 2.1.1. “uncontaminated soil can be classified as Inert without testing”.

As such, given the testing results, currently the underlying soils from the site are considered to be classified as follows:

Willow Lawn – Waste Soil Classification				
Strata	**Classification**	**Description of Material**	**EWC Code**	**Recommended Landfill Tax Rate**
Made Ground	Non-Hazardous	“Naturally occurring soils and stones (sand/gravel/clay) including Group 2 materials: concrete & brick.”	17 05 04	Standard Rate
Natural Soils	Inert	“Naturally occurring soils and stones (sand, gravel and clay)”	17 05 04	Lower Rate

We recommend that analytical results relevant to the materials being disposed of should be provided to the landfill operators or waste management contractors to confirm whether it meets their licence agreements and to confirm tipping costs.

All wastes removed from site should be consigned, transported and disposed of in full accordance with all relevant UK legislation.

7.3.2 WAC Results – Woody Bay

The results show that the soil sample taken from the Made Ground at Woody Bay soil passes the Inert Waste criteria with the exception of Total Organic Carbon which was recorded at 6.7% with the limit value being 3.0%. However, there are certain situations where WAC exceedances may be discounted, but would need to discussed and agreed with the landfill operator (from EA,2103c).

These include a higher total organic carbon (TOC) limit may be permitted at an inert landfill provided the dissolved organic carbon (DOC) value of 500mg/kg is achieved at the soils own pH value. The DOC was recorded at 75mg/kg, therefore it may be possible to classify the Made Ground soils at Woody Bay as Inert Waste. The laboratory testing results are presented in the Appendices.

It is considered that the underlying natural soils beneath the site qualify in accordance with EU Council Decision 2003/33/EC para. 2.1.1. “uncontaminated soil can be classified as Inert without testing”.

As such, given the testing results, currently the underlying soils from the site are considered to be classified as follows:

Woody Bay - Waste Soil Classification				
Strata	**Classification**	**Description of Material**	**EWC Code**	**Recommended Landfill Tax Rate**
Made Ground	Inert	“Naturally occurring soils and stones (sand/gravel/clay) including Group 2 materials: concrete & brick.”	17 05 04	Lower Rate
Natural Soils	Inert	“Naturally occurring soils and stones (sand, gravel and clay)”	17 05 04	Lower Rate

Under section 63(2) of the Finance Act 1996 it states where a disposal to landfill consists mainly of qualifying material(s), but includes a small amount of standard-rated material, the whole load is taxable at the lower rate. As such, the surrounding Made Ground soils (excluding any Topsoil) are considered to be taxable at the lower rate.

We recommend that analytical results relevant to the materials being disposed of should be provided to the landfill operators or waste management contractors to confirm whether it meets their licence agreements and to confirm tipping costs.

All wastes removed from site should be consigned, transported and disposed of in full accordance with all relevant UK legislation.

7.4 RE-USE OF MATERIAL ON SITE

Currently, if surplus arisings are 'fit for re-use' on the site and have not been treated, its re-use is allowed within the planning law. If it needs treating prior to re-use, exemptions can be sought from the Environment Agency to allow this activity.

Based upon the human health and groundwater risk assessments, the Made Ground soils underlying Willow Lawn are not suitable for reuse unless placed beneath a suitable barrier (i.e. hardstanding) due to marginally elevated levels of polyaromatic hydrocarbons.

Based upon the human health and groundwater risk assessments, the Made Ground soils underlying Woody Bay are suitable for reuse as no significantly elevated levels of contamination was encountered. This analysis is, however, dependent on the agreement of the Local Authority.

8 RECOMMENDATIONS

We recommend a watching brief should be undertaken during the construction phase, and if during development any previously undiscovered contamination (including visual or olfactory evidence) is found then site management should be immediately informed and inspection by a suitably qualified person should be undertaken.

9 REFERENCES

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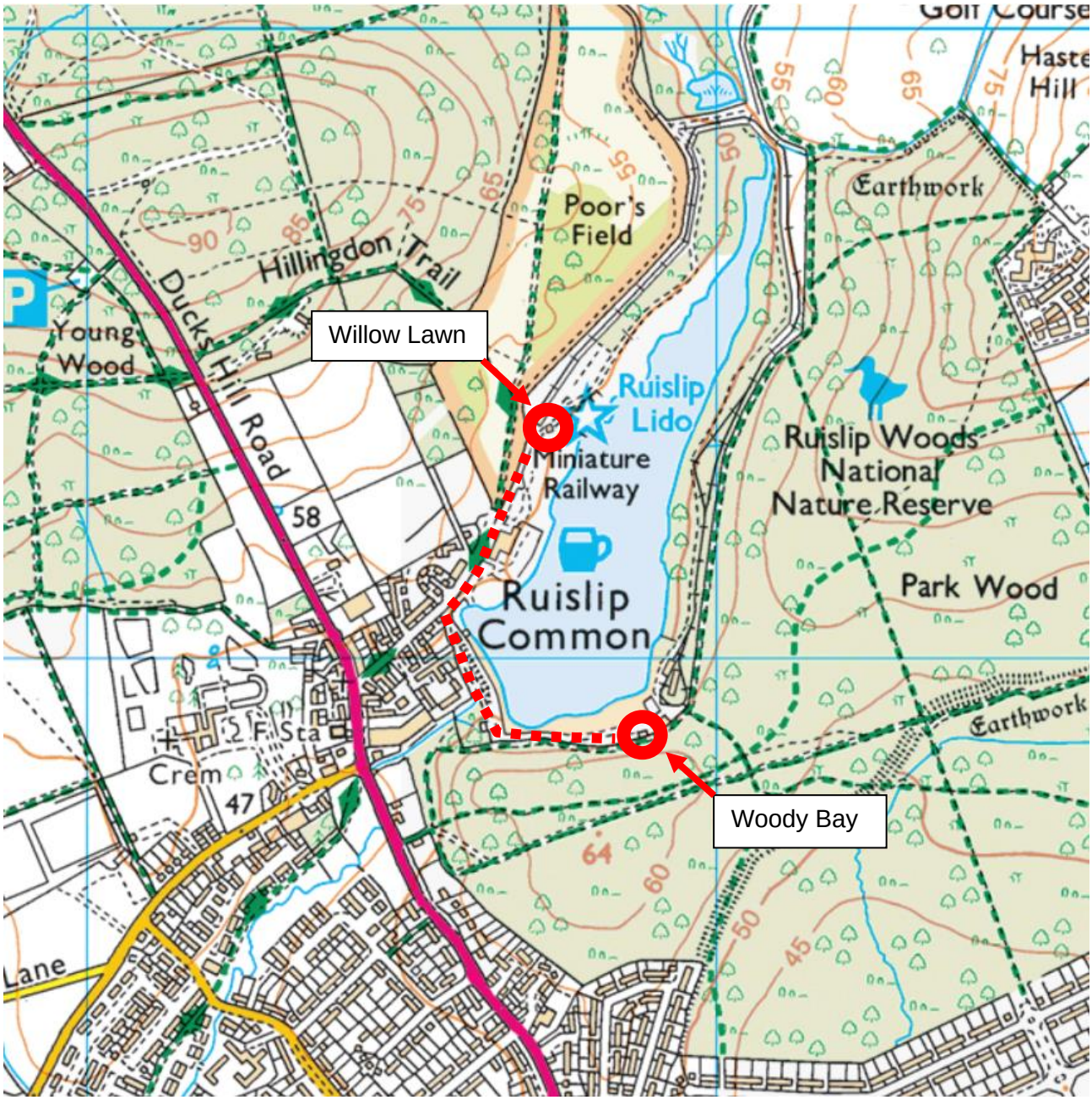
APPENDIX A

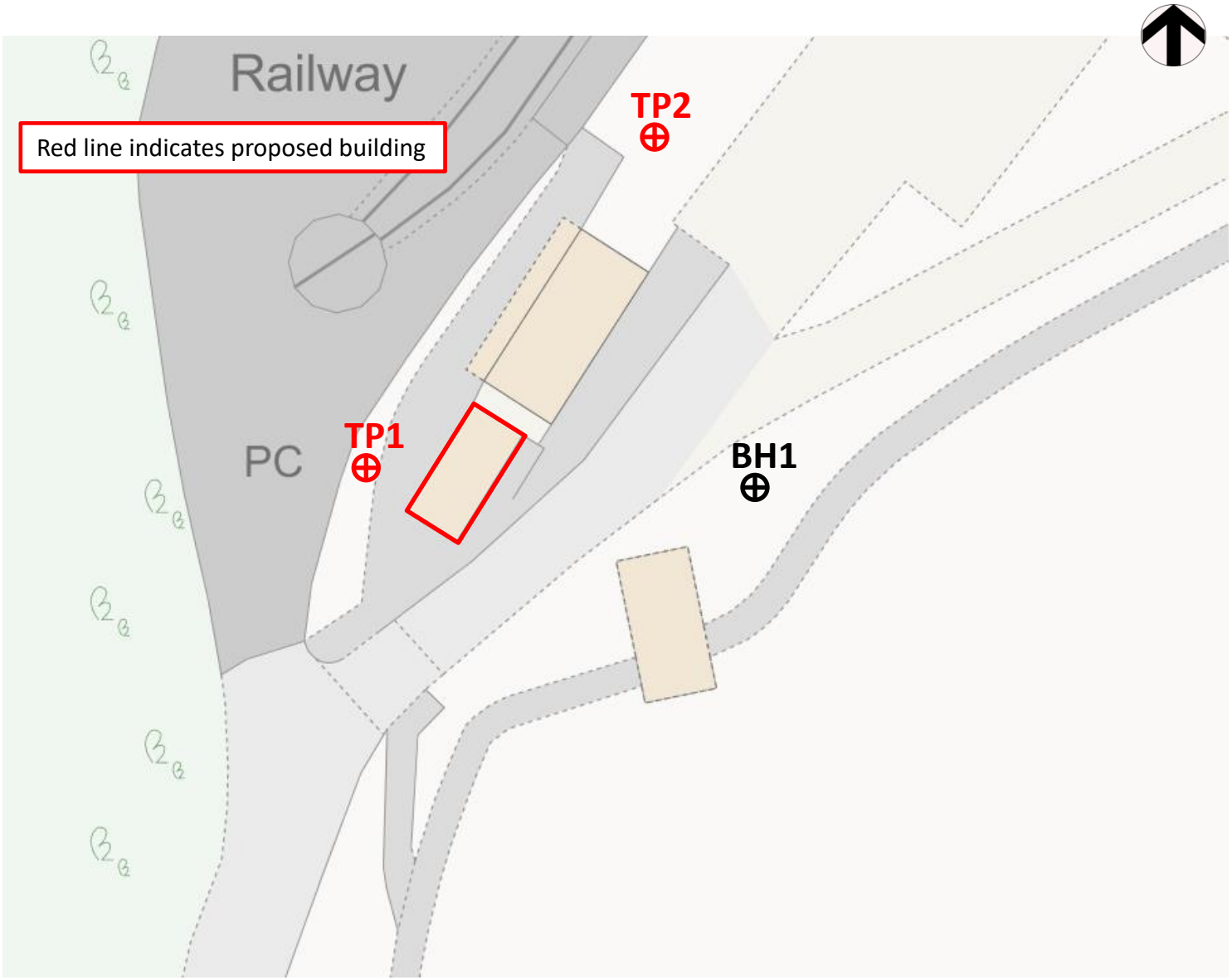
Geo-Integrity, Mob.: - 07858 367 125 Email:- info@geo-integrity.co.uk

Site Plan



March 2025 **SITE LOCATION PLAN** Report No:- 24-12-14

Geo-Integrity, - 07858 367 125 Email:- murraybateman@geo-integrity.co.uk



Key

- Trial Pit
- Cable Percussion Borehole

GEO INTEGRITY

4 Church Street
Maids Moreton
MK18 1QE

Tel:- 01280 816409
Mob:- 07858 367 125
www. geo-integrity.co.uk

Exploratory Hole Location Plan

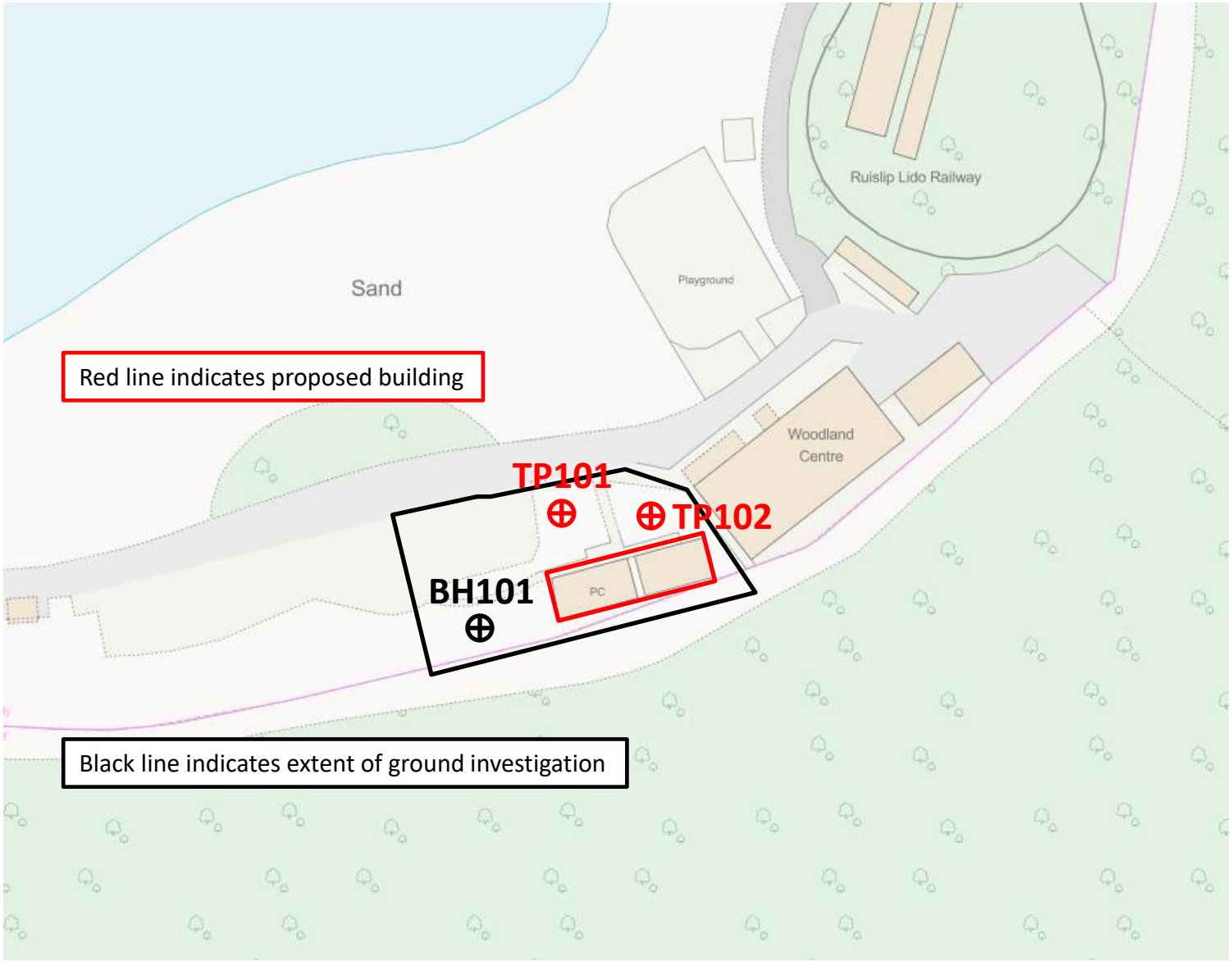
SITE:- Willow Lawn, Ruislip Lido

JOB NO.:- 24-12-14

CLIENT:- Hillingdon Council

Drawn	Checked
HF	LA

Scale: Not To Scale, for indicative purposes only



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Maids Moreton
MK18 1QE

Tel:- 01280 816409
Mob:- 07858 367 125
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Exploratory Hole Location Plan

SITE:- Woody Bay, Ruislip Lido

JOB NO.:- 24-12-14

CLIENT:- Hillingdon Council

Drawn	Checked
HF	LA

Scale: Not To Scale, for indicative purposes only