

# Appendix E – Phase I Geo-environmental Assessment

# FINAL

**MACE Group & Hillingdon Borough Council**

**Phase I Environmental Desk Study Report**

**Hillingdon Outdoor Activity Centre,  
Broadwater Lake,  
Moorhall Road,  
Harefield,  
UB9 6PE**

**Report No: 22-10-12**

**November 2022**



## DOCUMENT RECORD

Report Title Phase I Desk Study Report

Project Address Hillingdon Outdoor Activity Centre, Broadwater Lake, Moorhall Road, Harefield UB9 6PE

Project Number 22-10-12

Client Company Name MACE Group & Hillingdon Borough Council

Issue No Date	Status	Prepared by	Checked by
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		SIGNATURE 	SIGNATURE 

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### **APPENDIX A - PLANS AND PHOTOGRAPHS**

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-  Potential Contamination Sources
-  Historical Site Photographs
-  Site Photographs

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-  Natural Cavities Risk Assessment
-  Historical Borehole Logs
-  Historic Ordnance Survey Maps
-  Groundsure Datasheet

## **PHASE I DESK STUDY REPORT**




### **1 INTRODUCTION**

#### **1.1 SCOPE AND OBJECTIVES**

Geo-Integrity Ltd were commissioned by MACE Group, on the 21<sup>st</sup> October 2022, Purchase Order No. MLIMPD0018788, on behalf of Hillingdon Borough Council, to undertake a Phase I Desk Study at Hillingdon Outdoor Activity Centre, Broadwater Lake, Moorhall Road, Harefield UB9 6PE. The land is centred at OS Reference TQ 04373 89581.



This report is likely to be submitted as part of a planning application to redevelop the site. Once the development is completed, and as a minimum, 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 this desk study report is the first stage in investigating whether the site is likely to be considered "contaminated", in accordance with clause 184 of the NPPF.

The objectives of this Phase I geo-environmental desk study report are:-

-  To undertake a site walkover and identify any potential pollution sources on the site.
-  To gather historical, geological and environmental information.
-  To complete a preliminary site conceptual model so that potential pollutant linkages can be established and investigated further.

#### **1.2 PROPOSALS**

The proposed development involves the relocation of Hillingdon Outdoor Activity Centre to a new site adjacent to The Broadwater Lake. The proposed works for the development are detailed on Space and Place Architects drawing 3859(03)007 & 3859(03)008, which are attached in the Appendices. The scope of proposed works includes:

-  The construction of new facilities buildings - Includes main building, staff accommodation, workshops and rowing and race hut with additional smaller prefabricated accommodation units, storage containers and activity shelters. Maximum building height to be 2 storeys.
-  The construction of new car park and access road crossing the site.

- External works including landscaping and resurfacing to create hardstanding areas

### **1.3 SOURCES OF INFORMATION**

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

- Extracts of available historical Ordnance Survey (OS) maps covering the period from 1865 to 2022, which are presented in the Appendices.
- Groundsure Report Ref GS-9151609 included in the Appendices.
- The British Geological Survey (BGS) and Environment Agency (EA) websites.
- A site reconnaissance visit undertaken on 27<sup>th</sup> October 2022.
- Information from various internet sites on site history and environmental setting.

It should be noted that the information provided in the desk study is obtained from independent third party sources. It is provided in good faith, but no guarantee can be provided as to its accuracy. The desk study information is not necessarily exhaustive and further information relevant to the site may be available from other sources.

### **1.4 WALKOVER SURVEY**

A site walkover survey was undertaken on the 27<sup>th</sup> October 2022. Site location and layout plans are included in the Appendices, along with a selection of photographs taken during the survey.

The site is located to the west of Greater London, approximately 4km northeast of Junction 16 of the M25. It is in a predominantly rural setting, with the Grand Union Canal running down the east boundary of the main site and the River Colne marking the northern and western boundary of the main site. The southern boundary of the main site is marked by a flooded former sand and gravel extraction pit, called Harefield Pit, along with a group of residential properties and an aggregates business. There were also two outlier site marked on the site plan, Site 1 was located to south of Harefield Pit adjacent to Moorhall Road, and Site 2 was located to the east of the site, on the opposite side of the Canal adjacent to St Mary's Road and Broadwater Farm. A viaduct destined to carry HS2 was being constructed to the immediate southwest of the site, across the route of the River Colne, and there was a construction compound to the south of the main site and to the west of Site 1, along Moorhall Road.

The main site was approximately 1.2km north to south and 600m east to west, being about 70 hectares in area. The majority of the site consists of the Broadwater Lake with associated island

and a small area of land to the north that houses the Broadwater Sailing Club and car parking and the access track to this area, between the canal and the lake. Marker posts for a HP gas main were seen crossing the sailing club car park and land at this end of the site.

The main area of land is in the southeast corner of the lake where access is gained via the trackway from Moorhall Road to the south. This area is entered from the southeast corner where there is a small bungalow and associated gardens, the trackway extends westward from there, past an old weighbridge, then turning northward up towards the end of the land promontory. Along the trackway on either side old concrete constructions can be seen, including pits and large raised gantries. There was also a small sub-station to the east of the trackway, about halfway up. There are many small pathways off the trackway that all lead to individual or multiple fishing locations. One of these pathways leads along the southern boundary of the site and the lake, towards the River Colne. To the south of this pathway were remnants of the Harefield Pit that were overgrown with young willow sapling and marked as dangerous because of quicksand.

Site 1 was a small rectangular field with maximum dimension of 130m north to south and 60m east to west. It was located to the immediate east of the HS2 compound with Moorhall Road to the south and Harefield Pit to the north. It was covered with rough grass and weeds.

Site 2 was a small triangular site with maximum dimension of 130m from north to south and 90m across the base from east to west. Its area was approximately 0.7 hectares. Access to the site was not possible, as the route in was blocked by a transport yard and domestic housing, however, looking at the site from the opposite side of the Canal, it appeared to be complete overgrown with shrubs and trees.

There were no significant pollution sources located on the site during the walkover. However, on the main land area of the main lake there were a number of historical industrial remnants (such as weighbridge, hoppers and conveyor gantries, electricity sub-station). These will obviously provide a point source of historical contamination, such as oil spillage.

## 2 GEOLOGY

### 2.1 PUBLISHED GEOLOGY

Reference to the British Geological Survey website and Sheet 255; Beaconsfield 2005, indicates that the site is underlain by Worked Out Ground, Alluvium, Shepperton Gravel and Newhaven Chalk.

**Alluvium** is ground associated with the nearby River Colne and would consist of interbedded clays, silts, sands and gravels, with localised peat, associated with flooding events and the meandering of the river across the valley floor.

**Shepperton Gravel Member** is of Devensian age from the last Ice Age. It is designated as a River Terrace Gravels, which means it is formed as one of a series of level surfaces in a river valley, produced as the dissected remnants of earlier abandoned floodplains. It generally consists of sand and gravel, locally with lenses of silt, clay or peat, although this is what would have been removed across the majority of the site area.

**The Newhaven Chalk** formerly the Upper Chalk, is generally described by the British Geological Survey as a smooth white chalk with numerous marl seams and flint bands. The thickness of this unit in the site area is typically between 90m and 130m.

#### 2.1.1 *Historical Borehole Data*

The British Geological Survey holds records of exploratory holes, historically put down across the United Kingdom during historical investigation. There are two historical boreholes located on the site, that were put down by Affinity Water in 2013. Both found Alluvium and Shepperton Gravel to depths ranging from 3.50m bgl to 6.0m bgl with Chalk beneath that to a maximum depth of 76.50m below ground level. Groundwater depth in both boreholes was encountered at between 1.20 and 1.80m bgl

#### 2.1.2 *Solution Features*

Chalk, as a calcium-carbonate rich rock, is highly susceptible to dissolution by water containing carbon dioxide. This dissolution can create three common types of features within the chalk, grouped together under the generic term 'dissolution features'. These features include:

- *Sinkholes*: Depressions at the ground surface caused by the collapse of overlying chalk or superficial deposits into underground voids created by dissolution. Shape and size dependent on underlying void feature
- *Solution pipes*: A feature in the surface of the Chalk caused by increased dissolution in an area of closely spaced discontinuities. These features may, or may not, have a ground surface expression. Up to 20 metres diameter though commonly much smaller
- *Swallow Holes*: A void within the surface of the Chalk where a stream is 'swallowed' by the Chalk to flow underground. Often occur at the junction of impermeable strata and Chalk. Infilled ancient swallow holes do exist where streams used to flow and may not have any surface expression. Up to 14m in diameter, though commonly a few metres.

### **2.1.3 Natural Cavities Risk Assessment**

A natural cavities risk assessment has been undertaken following the paper written by Clive Edmonds in 2001, 'Predicting natural cavities in chalk'. This gives a score to various factors including; type of chalk, topography, groundwater level, strata overlying the chalk, periglacial and glacial history. The score for this site was 28, which means there is predicted to be No Anticipated Subsidence Hazard risk of natural cavities beneath this site (0% occurrence).

## **2.2 PREVIOUS WORK**

To our knowledge there has been no previous investigation on the site.

## **3 HISTORY OF THE SITE**

The history of the site has been established by the review of old Ordnance Survey maps going back to 1865 and internet searches. The maps and any other relevant information are included in the Appendices and indicated the following.

### 3.1 ORDNANCE SURVEY

The historical maps start in 1865 and it can be seen at this time that the site area is mainly open agricultural land with a network of ditches across it. It was named Harefield Moor, presumably due to the damp nature of the ground. The Grand Union Canal has been constructed along the eastern boundary at this time and the River Colne marked the northern boundary. There are no significant buildings on the site at this time, only a few farm building to the north of the site. Off site there is a chalk pit and kilns marked to the immediate east of the canal, about halfway up the main site. In addition, there is a large industrial complex of mills 750m north of the site and a small Flour Mill to the immediate north of the site, "Jacks Mill". Site 1 and 2 are open agricultural fields at this time.

The main site and Sites 1 and 2 remain the same, but in 1897 it can be seen that the Lime Kilns to the east of the site have expanded by that time, with a larger borrow pit having been dug also. In addition, the mill building 750m to the north of the site are marked as Asbestos Mills. This was the United Asbestos Mill which was open in this location from 1890 to 1920; these had previously been copper and paper mills.

The sites again remain undeveloped, but by the 1930s, residential development can be seen to the southeast of the main site, along Uxbridge Road; and the Brick and Cement Works to the east has expanded greatly with tramway and several disused chalk pits.

No significant change occurs until the plan of 1960, when although the site remains the same, it can be seen that gravel extraction has begun to the north and south of the site, with Harefield Pit and Troy Mill Gravel Pit both having been extracted and shown as lakes.

The plan of 1968 shows that the Cement and Brick Works had been reused as a refuse tip by that date, and it shows that gravel extraction from the main site area had start by that date with the central and southwest areas having been extracted. It is not until the plan of 2001 that the site boundaries as seen during the walkover are the same, and this involves a large amount of refilling to the west of the land promontory on the main site (therefore this is not original land). The plan shows this refilling occurring around the middle of the 1990's. Little change occurs to Sites 1 and 2.

### **3.2 UNEXPLODED ORDNANCE AND BOMB SITES**

Reference to an online UXO risk map produced by Zetica indicates that the site is located in an area where there is a low risk of unexploded ordnance. Low risk regions are those with a bombing density of less than 15 bombs per 1000 acres or less.

## **4 DESK STUDY INFORMATION**

### **4.1 HYDROLOGY**

The nearest surface water course is obviously on the site, Broadwater Lake. However, the nearest surface water abstraction licenses is 1156m south of the site at the Buckinghamshire Golf Co for top up and make up water for irrigation.

### **4.2 HYDROGEOLOGY**

Reference to the Groundsure report indicates that the site is located on a Secondary A Superficial Aquifer, and is located on a Principal Bedrock Aquifer.

The aquifer designation data is based on geological mapping provided by the British Geological Survey. The maps are divided into two different types of aquifer designation:

Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels.

Bedrock - solid permeable formations e.g. sandstone, chalk and limestone.

For each type there are four designations:- Principal, Secondary A, Secondary B and Unproductive Strata, ranked by importance.

The nearest active groundwater abstraction licenses are within 100m south of the site. They are run by Affinity Water at Northmoor Pumping Station.

The site is located in a Source Protection Zone 1 (SPZ1 – inner catchment). A Source Protection Zone (SPZ) is a designated area around a well or abstraction borehole. The inner catchment is the zone 50 day travel time of pollutant to source with a 50 metres default minimum radius. It is the most sensitive and means that the Environment Agency would require a developer to prove their proposals do not have the potential to pollute or harm groundwater.



## **4.3 WASTE**

### *4.3.1 Landfills*

Reference to records from the BGS, the Environment Agency and the Local Authority indicates that there is one historic landfill on the site. This is located to the southeast of the main site on the eastern side of the land promontory. It was run between 1993 and 2004 and was run by LaFarge Aggregates and was used to dispose of Non-Biodegradable Waste.

In addition to this there are three further landfills within 500m of the site. The closest is the old Brick and Cement Works to the east. This was used as a Refuse Tip between 1954 and 1974 run by WW Drinkwater and used for Commercial and Household waste.

The second was 189m southeast of the site at Harefield Marina from 1947 for household and industrial waste and the third was 387m to the northwest at Pynesfield Inert Landfill, Tilehouse Lane between 2018 and 2021 run by Ingrebourne Valley

### *4.3.2 Other Waste Treatment Sites*

There are six waste exemption records within 250m of the site. These include Screening and blending of waste, treatment of waste wood, use of waste in construction, burning waste and spreading of plant matter to confer benefit. These are to do with the various industrial land uses around the site, including the Aggregates Company to the south, the pumping station on the opposite side of Moorhall Road and the HS2 construction site.

## **4.4 LOCAL INDUSTRY AND ENVIRONMENTAL PERMITTING**

### *4.4.1 Local Industry*

Reference to the Groundsure Datasheet indicates that there are eleven existing industrial processes within 200m of the site. These include the aggregates company, the pumping station, a haulage company to the south of Site 2, sub-stations, and lifting and handling company, a business park, electrical components company and caravan sales yard.

### *4.4.2 Environmental Permitting and Incidents*

Reference to the Groundsure Datasheet indicates that there are no historic IPC authorisations within 500m of the site. There are no records of any Part A(1) licensed industrial activities within

500m, and one historical record of Part A(2)/B licensed pollutant release, use of bulk cement 27m south of the site. There has been one licensed discharges to controlled waters on site into the Harefield Lake in 1985 of sewage discharges. The second was for cooling water into the Greenbourne Stream

#### **4.5 ENVIRONMENTAL DESIGNATIONS**

The whole of the main site is designated as an SSSI, which are Sites providing statutory protection for the best examples of UK flora, fauna, or geological or physiographical features. Originally notified under the National Parks and Access to the Countryside Act 1949, SSSIs were renotified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000 (in England and Wales) and (in Scotland) by the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2010.







#### **4.6 GROUND GASES**

##### *4.6.1 Radon*

Information from the British Geological Survey and the National Geoscience Information Service indicated that the site lies within an area where less than 1% of homes exceed the action level of 200Bq/m<sup>2</sup> for radon gas. Therefore, no radon protection measures are necessary in the construction of new dwellings or extensions on this site.

##### *4.6.2 Landfill Gasses*

In accordance with BS8576:2013 the site has been provisionally assessed for the risk of ground gases. This has been done with reference to “A pragmatic approach to ground gas risk assessment for the 21st Century” Card and Wilson, 2011.

-  There are a number of possible source-pathway-receptor linkages for landfill gas migration.
-  The site is located near to a historic landfill.
-  The Made Ground is expected to be 5m deep or an average of 3m in thickness.
-  The site is located on carbonate rich rock that can produce low levels of carbon dioxide.
-  Radon protection measures are not required for this site.
-  The site does lie on a potential naturally organic soil or humic or degradable Made Ground soil.

As such it is considered that the risk of ground gas is high and ground gas monitoring is therefore recommended at this site.

#### 4.7 POTENTIAL GEOTECHNICAL HAZARDS

The desk study information identified that the site does not lie within an area likely to be affected by significant natural cavities, coal mining or non-coal mining activities.

The risk of naturally occurring geotechnical hazards at the site is recorded in the Groundsure report to be as follows:








Ground Stability Hazard	Maximum Hazard Potential Rating
Collapsible deposits	Very Low
Compressible deposits	Moderate
Ground dissolution of soluble rocks	Very Low
Shrinking and swelling clays	Very Low
Landslides	Very Low
Running sand	Low

During the walkover survey a large area of land to the south of the main site was marked as dangerous from quicksand, this will have been from the infilling of a sand and gravel pit by silt wastes. In addition, the land areas on the site have been highly reworked and used as a landfill site in the past. As such, deep thicknesses of Made Ground should be anticipated across the whole site. Groundwater will also be within a metre or two of existing ground level

#### 4.8 FORMER SITE USAGE AND POTENTIAL CONTAMINANTS

Historically the site has been drained marsh land adjacent to the River Colne until the 1960's when it started to be exploited for its underlying sand and gravel deposits. Processing of this material occurred towards the southeast of the site, accessed from a trackway leading down to Moorhall Road to the site. Extraction continued until the end of the 1990's. Currently the site area is a Nature Reserve and the lake is used by fishing clubs and the Broadwater Sailing Club, there is also one residential house to the very southeast corner of the main site.

As such, the main risk of potential contaminant sources comes from its industrial history as a gravel pit between the 1960's and 1990's, and the landfilling that occurred on the site between 1993 and 2004. The following contaminants should be expected and these will be concentrated around the structures on the land promontory and in the area of the landfill, as shown on the attached site plan:-

-  Metals and Inorganic Substances
-  Speciated Polyaromatic Hydrocarbons (PAH)
-  Benzene, Toluene, Ethylbenzene and Xylene (BTEX)
-  Total Petroleum Hydrocarbons (TPH)
-  Asbestos Identification and Quantification
-  Semi Volatile and Volatile Organic Substances
-  Polychlorinated biphenyls around the electricity sub-station (PCB's)

## **5 SUMMARY OF GEOTECHNICAL RISK**

The site where the majority of development is expected is the land promontory to the southeast of the main site. This has been used for processing aggregate and as such it is anticipated the underlying soil profile will consist of thick Made Ground with some concrete obstructions, Shepperton Gravel with Chalk strata at approximately 6m below ground level. Groundwater is likely to be between 1m to 2m below ground level.

Therefore, it is anticipated that piled foundations will be required for any structure with specific settlement criteria; road pavements will require a flexible reinforcement and buildings are likely to require protection from ground gas.

Site 2 is likely to be underlain by Newhaven Chalk strata, which should provide a relatively good building platform, but Site 1 will be underlain by Alluvium overlying Shepperton Gravel. The Alluvium is likely to be made up of peat and water saturated sandy clays.

Therefore it is recommended that an intrusive investigation is undertaken at an early stage to identify the soil type beneath the site, and depth to groundwater, to minimise delays during the design stage.

## **6 INITIAL CONCEPTUAL SITE MODEL**

In accord with the Environment Agency LCRM “Land Contamination Risk Management” 2020, this desk study and site reconnaissance report constitutes a preliminary risk assessment in order to establish the potential presence of pollutant linkages.

Reference to the desk study and walkover survey indicates that the site has been in agricultural usage from at least 1881 until the 1960’s when it started to be exploited for its underlying sand and gravel deposits. Processing of this material occurred towards the southeast of the site, accessed from a trackway leading down to Moorhall Road to the site. Extraction continued until the end of the 1990’s. Currently the site area is a Nature Reserve and the lake is used by fishing clubs and the Broadwater Sailing Club, there is also one residential house to the very southeast corner of the main site.

Given the proposed development of the site as a commercial end usage, it is considered that there is a low to moderate risk to end users. However, the risk of encountered localised pockets of contamination is considered to be moderate to high. There is also a perceived moderate risk of encountered a contamination sources that may be affecting the Principal groundwater Aquifer beneath the site and as the site is in a Source Protection Zone, this would need to be dealt with as part of the development.

The surrounding uses of the site generally poses no risk of contamination, however, there is a large old landfill site to the east of the site that is undoubtedly a large source of landfill gases.

The majority of the rest of the land use on the site is a nature reserve and as such no potentially contaminative land uses have been identified.

Therefore, the following potential source/pathway/receptors may be present at and around the site;


Potential Source	Potential Pathway	Potential Receptor	Considered Risk
Historic hydrocarbons within the ground from human history in the area of aggregate processing	Volatile vapours possible	End Users	Low to moderate
	Leaching through the ground	Controlled Waters	Locally high
Historic asbestos within any made ground from human history in the area of aggregate processing	Ingestion, inhalation or absorption from direct contact with soil.	End Users	Low to moderate
	Possible contact during work phase	Construction Workers	Moderate to high
Historic metals and PAH's within any made ground from human history in the area of aggregate processing	Ingestion, inhalation or absorption from direct contact with soil.	End Users	Low to moderate
	Possible contact during work phase	Construction Workers	Moderate to high
Ground gas from nearby landfill sites	Lateral migration through River Terrace Deposits (very unlikely)	End Users	Low to moderate
PCB from electricity sub-station	Ingestion, inhalation or absorption from direct contact with soil.	End Users and Construction Workers	Low to moderate

## 7 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER WORK

From the information gathered as part of this investigation are a number of potential contaminative sources on site. The site has been a Nature reserve for several years and has not been used for industrial processes; as such a certain amount of natural attenuation is likely to have occurred to any area of contamination. As such, it is considered that the site is likely not to be determined as 'contaminated land' under the terms of Part IIA of the Environmental Protection Act 1990. As such this would pass that test set out in clause 183 of the NPPF. However, it is considered that the site could be classified as being "affected by contamination" and as such the site may not pass the test set out in clause 184 of the NPPF, and some remediation may be required.

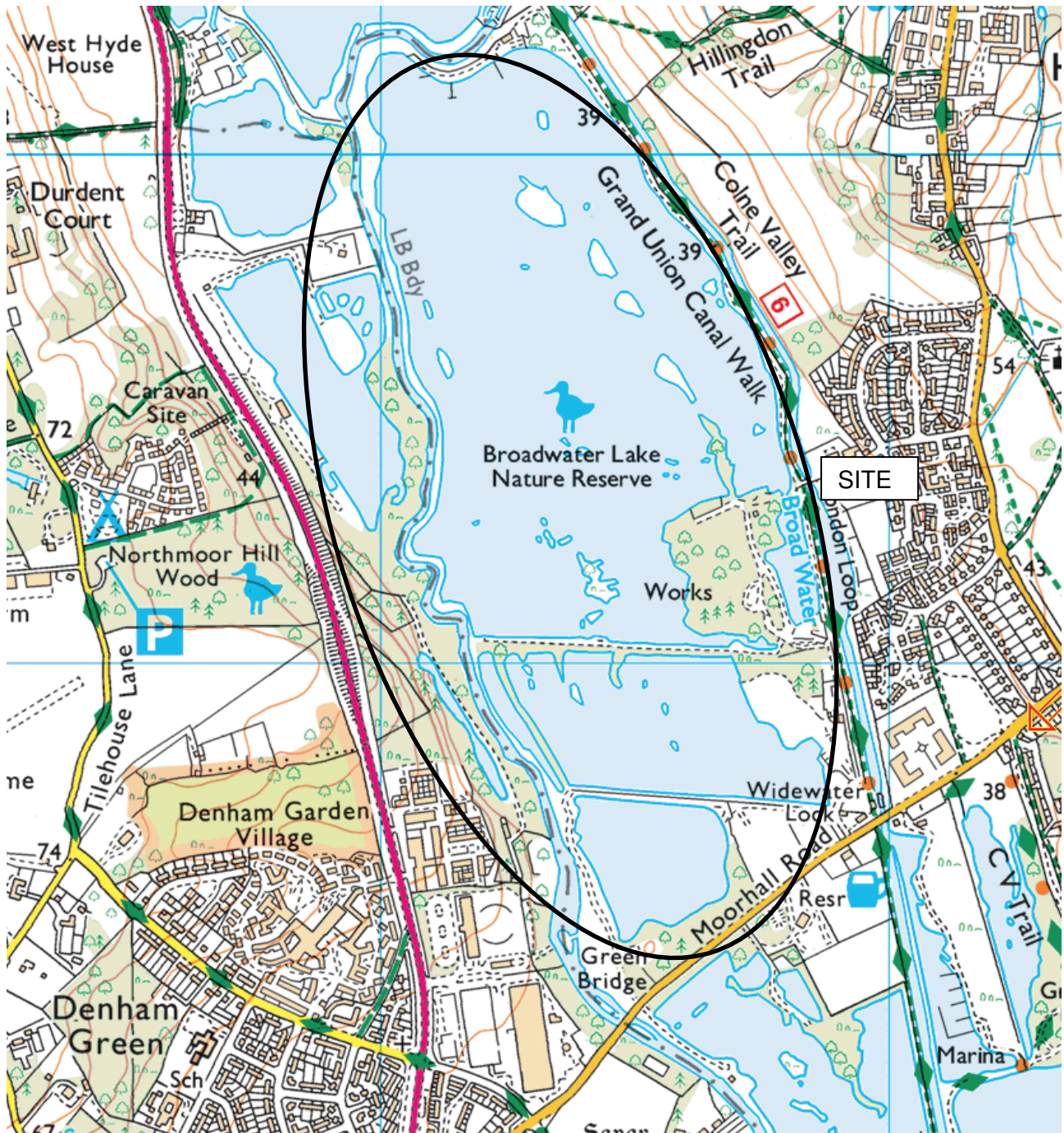
***Therefore, we recommended that further intrusive site investigation works are undertaken to establish contamination levels, mainly in the promontory land on the main site area to quantify any risks. In addition, in order to establish construction methods for the proposed development the ground profile and soil parameters will be required.***

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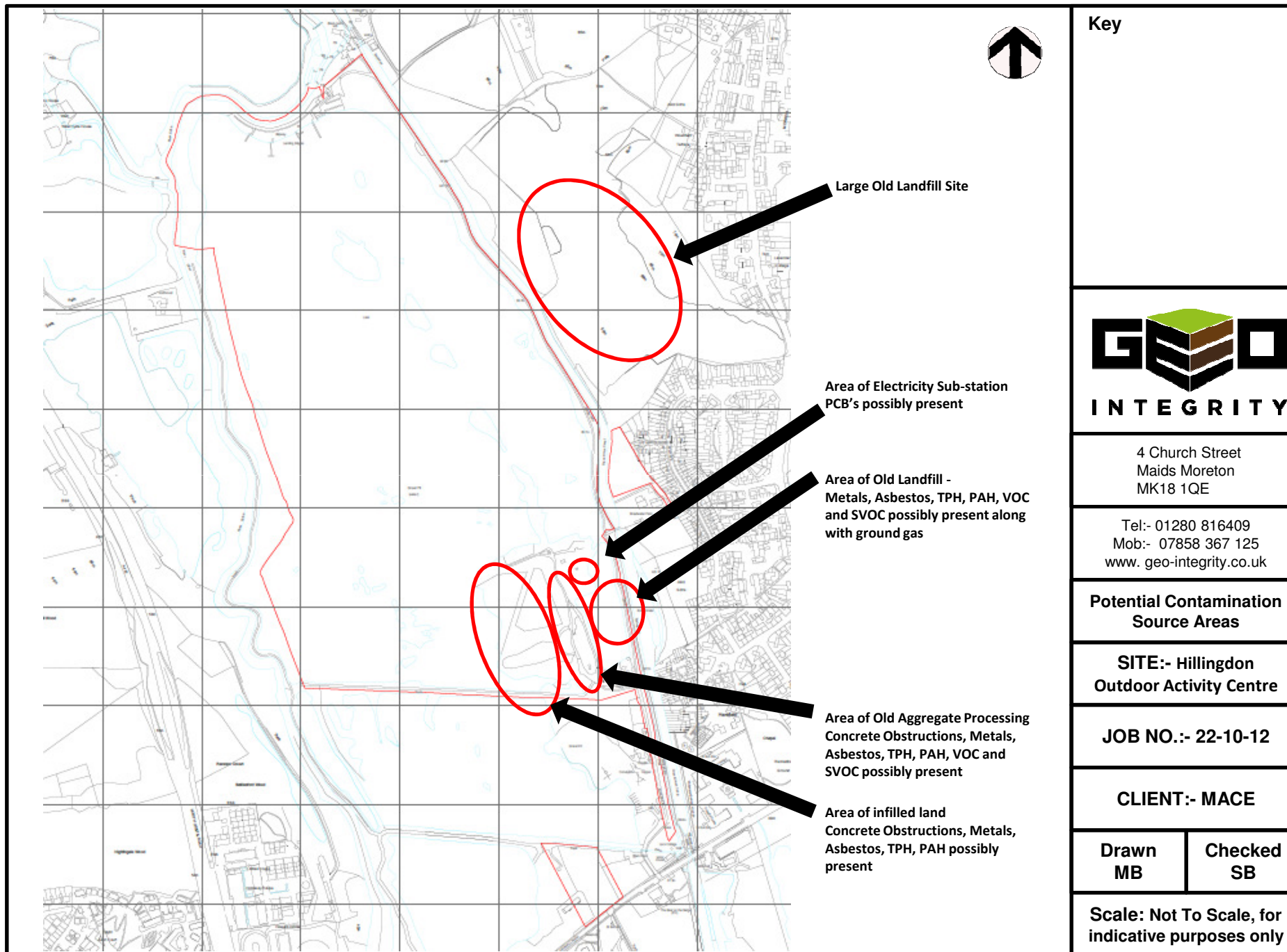
## **APPENDIX A**



November 2022

**SITE LOCATION PLAN**

Report No:- 22-10-12



Key



4 Church Street  
Maids Moreton  
MK18 1QE

Tel:- 01280 816409  
Mob:- 07858 367 125  
[www. geo-integrity.co.uk](http://www.geo-integrity.co.uk)

**Potential Contamination  
Source Areas**

**SITE:- Hillingdon  
Outdoor Activity Centre**

**JOB NO.:- 22-10-12**

**CLIENT:- MACE**

**Drawn  
MB**

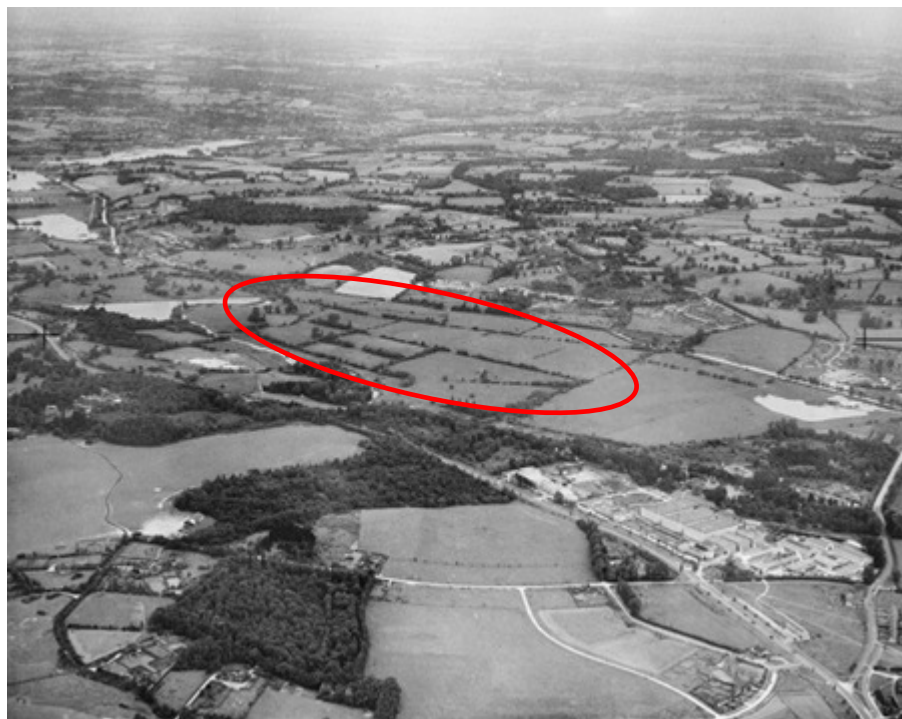
**Checked  
SB**

**Scale: Not To Scale, for  
indicative purposes only**





1933



1946



Residential House at site entrance



Weighbridge at site entrance

November 2022

**SITE PHOTOGRAPHS**

22-10-12





Quicksand to the immediate south of the site area



Path along southern boundary of main site

November 2022

**SITE PHOTOGRAPHS**

22-10-12





Main Lake from the south



Remnants of conveyor structure on main site

November 2022

**SITE PHOTOGRAPHS**

22-10-12





Electricity Sub-station on main site



Track leading up the east of the site towards the sailing club

November 2022

**SITE PHOTOGRAPHS**

22-10-12





Gas main at top of site



Sailing club at north of site

November 2022

**SITE PHOTOGRAPHS**

22-10-12





Looking across the Grand Union Canal towards Site 2



Site 1 from Moorhall Road – HS2 compound to the left of the photo

November 2022

**SITE PHOTOGRAPHS**

22-10-12

## **APPENDIX B**

# Natural Cavities Risk Assessment



**Project Name :** Broadwater Lake

**Project No :** 22-10-12

**Client :** Hillingdon BC and MACE

**This site has a No Anticipated Subsidence Hazard Category**

Subsidence Hazard Components	Value
G1 - Chalk lithostratigraphic Factor	20
G2 - Post Cretaceous Cover Deposit Factor	7
H1 - Water Table Level Factor	1
H2 - Topographic Relief and Surface Drainage/Subsurface Infiltration Factor	1
GM1 - Former Surface Water Drainage Path Factor	0
GM2 - Glaciation Factor	0
<b>SHR<sub>N</sub> = (G1+G2+H1+GM1+GM2)*H2</b>	<b>SHR<sub>N</sub> Value 28</b>

SHR <sub>N</sub>	Subsidence Hazard Category
<55	No Anticipated Subsidence Hazard
55 to 89	Very Low Subsidence Hazard
90 to 136	Low Subsidence Hazard
137 to 200	Moderately Low Subsidence Hazard
201 to 300	Moderate Subsidence Hazard
301 to 400	Moderately High Subsidence Hazard
401 to 600	High Subsidence Hazard
>600	Very High Subsidence Hazard

## Regional Abbreviations used on Sheets 2 and 3

CH	Chiltern Hills
DPD	Dorset and Purbeck Downs
EA	East Anglia
END	East North Downs
L	Lincolnshire
WND	West North Downs
Y	Yorkshire

### Notes:

Based on Edmonds C N : 2001 :  
Predicting natural cavities in chalk  
Geological Society, London, Engineering Special  
Publications, Vol 18, pp 29-38

**Project** Broadwater Lake  
**Project No.** 22-10-12  
**Carried out for** Hillingdon BC and MACE

### Table

**1**  
**(Sheet 1 of 3)**



British  
Geological  
Survey

Version 2.0.6.6

BGS ID: 19289652 : BGS Reference: TQ08NW640  
British National Grid (27700) : 504100,189300

[Report an issue with this borehole](#)

<< < Prev Page 1 of 1 Next > >>

TQ08/130

**Driller...Herbie.....**

British Geological Survey

British Geological Survey

British Geological Survey

## SMITH & WEBB (DRILLING) LTD BORING RECORD

Site Denham B.H. No 3

Client Affinity Water Ltd

Site Address Broadwater NGR TQ 041 893

Boring Started 25<sup>th</sup> January 2013 Boring Completed 4<sup>th</sup> February 2013 Level 150mm &

Dia. of Bore 250mm Cased to 10.50m b.s. with 250mm dia. casing and to 22m b.s. with 150mm dia. casing

Water struck at: (1) 1.20m b.s. (2)          b.s. (3)          b.s. (4)          b.s.

Standing W.L. in bore at 1.20m on          b.s.

Remarks 22m of 150mm diameter steel lining tube installed. Shingle installed with bentonite seal

	DEPTH		THICKNESS	SAMPLE DETAILS		
	FROM	TO		NO.	TYPE	DEPTH
Topsoil	G.L.	1.20	1.20			
Sand & gravel	1.20	6.00	4.80			
Gravel & chalk	6.00	6.30	0.30			
Chalk & flints	6.30	57.00	<u>50.70</u> <u>57.00</u>			

TQ 08/131

Driller...Herbie.....

British Geological Survey

British Geological Survey

British Geological Survey

## SMITH & WEBB (DRILLING) LTD BORING RECORD

Site Denham B.H. No 5

Client Affinity Water Ltd

Site Address Broadwater NGR TQ 047 896

Boring Started 12<sup>th</sup> February 2013 Boring Completed 25<sup>th</sup> February 2013 Level 150mm &

Dia. of Bore 250mm Cased to 10m b.s with 250mm dia. casing and to 34.50m b.s. with 150mm dia. casing

British Geological Survey

Water struck at: (1) 1.80m b.s. (2)                      b.s. (3)                      b.s. (4)                      b.s.

British Geological Survey

British Geological Survey

Standing W.L. in bore at 1.10m on                      b.s.

Remarks 34.5m of 150mm diameter steel lining tube installed. Shingle installed with bentonite seal

	DEPTH		THICKNESS	SAMPLE DETAILS		
	FROM	TO		NO.	TYPE	DEPTH
Topsoil	G.L.	0.30	0.30			
Silty clay	0.30	0.50	0.20			
Blue clay	0.50	1.00	0.50			
Peaty soil	1.00	1.80	0.80			
Sand & gravel	1.80	3.50	1.70			
Chalk & flints	3.50	80.00	<u>76.50</u> <u>80.00</u>			

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey