

26 October 2022

Our ref: J22242

FAO Richard Densham
Mace Group Limited
155 Moorgate
LONDON
EC2M 6XB



GEA

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Dear Richard

Re: HILLINGDON OUTDOOR ACTIVITY CENTRE (BROADWATER LAKE), UXBRIDGE UB9 6PB

Further to your instruction of 25th July 2022, we have now completed the sampling and testing exercise at the above location. The purpose of the exercise was to assess the suitability of the water in Broadwater Lake for the use of recreational water sports, swimming, and leisure activities, as part of the redevelopment of the site to create an outdoor activity centre.

The conclusions and recommendations made in this letter are limited to those that can be made on the basis of the work carried out. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or ground water samples tested. No liability can be accepted for conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from third parties are given in good faith on the assumption that the information is accurate; no independent validation of third-party information has been made by GEA.

1.0 Introduction

GEA attended site on 22 August 2022 and sampled water from the lake at six locations along the shoreline, ensuring a representative spread of locations was achieved. A plan showing the sampling locations is enclosed.

The sampling methodology was in accordance with the requirements of the laboratories undertaking the testing. The samples obtained were sent for microbiological and chemical analysis, including total coliforms, E.coli, Faecal Streptococci, pH, blue-green algae, salmonella and clostridia. All analysis was carried out in UKAS accredited laboratories, and the suite of testing was agreed with Mace Group prior to our attendance on site.

2.0 Site Description

The site comprises part of Broadwater Lake, including a peninsula of land located immediately north of the Harleyford Aggregates quarry, as show on the enclosed location plan. Much of the land portion of the site comprises areas of woodland, although it is understood that the site was previously used as a quarry, and the remains of a number of structures are present. Various waste materials can also be found across the site and within the water close to the shoreline, including but not limited to concrete blocks, fragments of metal, and vehicle parts. A full desk study to research the history of the site is to be completed in due course.

3.0 Test results

The results of the analysis have been compared to EC Bathing Water Directive (76/160/EEC)¹ or EC Bathing Water Directive (2006/7/EC)². The testing has indicated that in general, concentrations of Total coliforms, E.coli and Enterococci were all either recorded as 'Pass Guideline' or 'Pass Excellent' for all six samples. However, the Enterococci concentration in Location No 1 was recorded at a concentration to warrant a 'Poor (fail)' rating with regards to EC Bathing water directive (2006/7/EC).

Six species of cyanobacteria (blue-green algae) were found within the samples collected from Location Nos 2 to 6, and seven species of cyanobacteria were found within the sample collected from Location No 1. The concentrations of cyanobacteria within the samples collected from Location Nos 1, 3 and 4 were found to be at a 'Moderate (Warning Threshold)' level, in accordance with the World Health Organisation (WHO rating) for algae present in water, whereas the concentrations within the samples collected from Location Nos 2, 5 and 6 were found to be 'Relatively Low'.

None of the samples were identified as containing salmonella. The concentrations of clostridium perfringens were recorded at levels between 0 colony-forming units per 100 ml and 200 colony-forming units per 100 ml. A summary of the test results is presented in the table below. The full results are enclosed, together with a site plan showing the sample locations.

Sampling location No	Grid reference	Determinant	Outcome
1	TQ 04626 89320	Total coliforms	Pass Guideline
		E. coli	Pass Guideline & Pass Excellent
		Enterococci	Poor (fail)
		Algae	Moderate (Warning Threshold)
		Salmonella	Not detected in 25 g
		Clostridium perfringens	0 cfu/100ml
2	TQ 04561 89278	Total coliforms	Pass Guideline
		E. coli	Pass Guideline & Pass Excellent
		Enterococci	Pass Excellent
		Algae	Relatively low
		Salmonella	Not detected in 25 g
		Clostridium perfringens	0 cfu/100ml
3	TQ 04550 89235	Total coliforms	Pass Guideline
		E. coli	Pass Guideline & Pass Excellent
		Enterococci	Pass Excellent
		Algae	Moderate (Warning Threshold)
		Salmonella	Not detected in 25 g
		Clostridium perfringens	100 cfu/100ml
4	TQ 04594 89081	Total coliforms	Pass Guideline
		E. coli	Pass Guideline & Pass Excellent
		Enterococci	Pass Excellent
		Algae	Moderate (Warning Threshold)
		Salmonella	Not detected in 25 g

¹ THE COUNCIL OF THE EUROPEAN COMMUNITIES (1975), Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water

² THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION (2006), DIRECTIVE 2006/7/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC

Sampling location No	Grid reference	Determinant	Outcome
		Clostridium perfringens	100 cfu/100ml
5	TQ 04590 89114	Total coliforms	Pass Guideline
		E. coli	Pass Guideline & Pass Excellent
		Enterococci	Pass Excellent
		Algae	Relatively low
		Salmonella	Not detected in 25 g
		Clostridium perfringens	200 cfu/100ml
6	TQ 04636 89413	Total coliforms	Pass Guideline
		E. coli	Pass Guideline & Pass Excellent
		Enterococci	Pass Excellent
		Algae	Relatively low
		Salmonella	Not detected in 25 g
		Clostridium perfringens	0 cfu/100ml

Figure in bold indicates fail with respect to EC Bathing water directive (2006/7/EC) or adopted threshold value

4.0 Advice and Recommendations

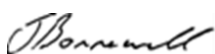
The results were generally found to meet the EC Bathing Water Directive (76/160/EEC and 2006/7/EC), with the exception of the concentration of Enterococci within the sample collected from Location No 1, which was classified as 'Poor (fail)'. None of the samples were found to contain salmonella, and all six samples were found to meet the WHO guidance values with respect to blue-green algae (cyanobacteria). The concentration of Clostridium perfringens recorded in the sample collected from Location No 5 is considered to be elevated with respect to the adopted threshold value for fecal coliforms, of 200 colony-forming units per 100 ml.

The testing was restricted to accessible areas of the shoreline, and additional testing is recommended further from the shoreline in areas of open water. Similarly, in line with Swim Safety guidance, in view of the 'Poor (fail)' result determined for Enterococci concentrations obtained from Location No 1, additional sampling and testing should be undertaken to accurately assess the water body in this respect, with the results used to inform the risk assessment for the intended proposed use. Further research is also recommended, in order to determine the likely source of the Enterococci and Clostridium perfringens, including checking for any effluent outfalls or storm water over flows entering the lake.

Furthermore, the testing was carried out on 22 August 2022, following a prolonged period of dry weather and record breaking temperatures, and the water level in the lake was noted to be lower than observed during our previous walkover visit on 6 July 2021. When reviewing the test results, climactic factors should be taken into account, and additional testing should be considered once water levels are higher, to test for seasonal variations, and to gain a more complete picture of the quality of the water body.

We trust that the above report provides sufficient information for your purposes at this time, but please do not hesitate to contact us if we can be of further assistance.

Yours sincerely
GEOTECHNICAL & ENVIRONMENTAL ASSOCIATES



Jack Bonnewell
Encs

Site	HILLINGDON OUTDOOR ACTIVITY CENTRE (BROADWATER LAKE), UXBRIDGE UB9 6PB	Job Number J22242
Client	Mace Limited	
Engineer		Sheet 1/1





Water Quality Results Certificate

Client: Geotechnical & Environmental Associates
Broadwater Lake

Certificate reference:
Report date:
Analysis start date:

ALG-GEA-22082022
30/08/2022
24/08/2022

Sample 1			
Algae species	Algae type	No of colonies or filaments/1ml	No of Cells/ml
Microcystis flosaquae (Phylum: Cyanobacteria, Order: Chroococcales)	'Blue-green' Colonies (50 cells)	309	15,450
Dolichospermum circinale (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (20 cells)	15	300
Aphanizomenon flosaquae (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (40 cells)	101	4,040
Gloeotrichia echinulata (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' colonies of filaments (ave 20000 cells)	<1	100
Woronichinia naegeliana (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (500 cells)	4	2,000
Pseudanabaena endophytica (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' filaments (6 cells)	<1	0
Aphanocapsa sp. (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (100 cells)	<1	0
Total cells/ml:			21,890
WHO rating:			Moderate (Warning Threshold)

Sample 2			
Algae species	Algae type	No of colonies or filaments/1ml	No of Cells/ml
Microcystis flosaquae (Phylum: Cyanobacteria, Order: Chroococcales)	'Blue-green' Colonies (50 cells)	138	6,900
Dolichospermum circinale (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (20 cells)	<1	0
Aphanizomenon flosaquae (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (40 cells)	15	600
Gloeotrichia echinulata (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' colonies of filaments (ave 20000 cells)	<1	100
Woronichinia naegeliana (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (500 cells)	<1	0
Aphanocapsa sp. (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (100 cells)	4	400
Total cells/ml:			8,000
WHO rating:			Relatively Low

Sample 3			
Algae species	Algae type	No of colonies or filaments/1ml	No of Cells/ml
Microcystis flosaquae (Phylum: Cyanobacteria, Order: Chroococcales)	'Blue-green' Colonies (50 cells)	452	22,600
Dolichospermum circinale (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (20 cells)	4	80
Aphanizomenon flosaquae (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (40 cells)	753	30,120
Gloeotrichia echinulata (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' colonies of filaments (ave 20000 cells)	<1	100
Woronichinia naegeliana (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (500 cells)	7	3,500
Aphanocapsa sp. (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (100 cells)	<1	0
Total cells/ml:			56,400
WHO rating:			Moderate (Warning Threshold)

Sample 4			
Algae species	Algae type	No of colonies or filaments/1ml	No of Cells/ml
Microcystis flosaquae (Phylum: Cyanobacteria, Order: Chroococcales)	'Blue-green' Colonies (50 cells)	91	4,850
Dolichospermum circinale (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (20 cells)	<1	0
Aphanizomenon flosaquae (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (40 cells)	1,043	41,720
Gloeotrichia echinulata (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' colonies of filaments (ave 20000 cells)	<1	100
Woronichinia naegeliana (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (500 cells)	<1	0
Aphanocapsa sp. (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (100 cells)	<1	0
Total cells/ml:			46,670
WHO rating:			Moderate (Warning Threshold)

Sample 5			
Algae species	Algae type	No of colonies or filaments/1ml	No of Cells/ml
Microcystis flosaquae (Phylum: Cyanobacteria, Order: Chroococcales)	'Blue-green' Colonies (50 cells)	170	8,500
Dolichospermum circinale (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (20 cells)	<1	0
Aphanizomenon flosaquae (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (40 cells)	10	400
Gloeotrichia echinulata (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' colonies of filaments (ave 20000 cells)	0	0
Woronichinia naegeliana (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (500 cells)	5	2,500
Aphanocapsa sp. (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (100 cells)	<1	0
		Total cells/ml:	11,400
		WHO rating:	Relatively Low

Sample 6			
Algae species	Algae type	No of colonies or filaments/1ml	No of Cells/ml
Microcystis flosaquae (Phylum: Cyanobacteria, Order: Chroococcales)	'Blue-green' Colonies (50 cells)	68	3,400
Dolichospermum circinale (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (20 cells)	10	200
Aphanizomenon flosaquae (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' filaments (40 cells)	366	14,640
Gloeotrichia echinulata (Phylum: Cyanobacteria, Order: Nostocales)	'Blue-green' colonies of filaments (ave 20000 cells)	<1	100
Woronichinia naegeliana (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (500 cells)	<1	0
Aphanocapsa sp. (Phylum: Cyanobacteria, Order: Synechococcales)	'Blue-green' Colonies (100 cells)	<1	0
		Total cells/ml:	18,340
		WHO rating:	Relatively Low



Water Quality Results Certificate

Comments

The samples were examined for the presence of Cyanobacteria at x400 magnification.

200ml of the sample was then filtered to concentrate the algal cells and then examined at up to x600 magnification.

Six species of cyanobacteria were found. Ranging from Relatively Low to Moderate Levels.

Microcystis is known to produce hepatotoxins as cells break down in blooms and scums. Aphanizomenon is known to produce neurotoxins in some blooms. The toxins produced by these cyanobacteria species may be harmful to humans, dogs and livestock.

The World Health Organisation (WHO Rating) above indicates levels of algae present in the sample(s), against WHO guidance values.

Please visit www.swim-safety.co.uk/results-guidance/ for more info on results thresholds.



Water Quality Results Certificate

Client: Geotechnical & Environmental Associates
Broadwater Lake

Certificate reference: TSBN1607352-1
Report date: 30/08/2022
Analysis start date: 25/08/2022

Sampling Results

Sample 1			
	Results	EC Bathing Water Directive (76/160/EEC)	EC Bathing Water Directive (2006/7/EC)
			(For inland waters)
Total coliforms (no/100 ml)	3	Pass Guideline	-
E. coli (no/100 ml)	1	Pass Guideline	Pass Excellent
Enterococci (no/100 ml)	1000	-	Poor

Sample 2			
	Results	EC Bathing Water Directive (76/160/EEC)	EC Bathing Water Directive (2006/7/EC)
			(For inland waters)
Total coliforms (no/100 ml)	0	Pass Guideline	-
E. coli (no/100 ml)	0	Pass Guideline	Pass Excellent
Enterococci (no/100 ml)	13	-	Pass Excellent

Sample 3			
	Results	EC Bathing Water Directive (76/160/EEC)	EC Bathing Water Directive (2006/7/EC)
			(For inland waters)
Total coliforms (no/100 ml)	0	Pass Guideline	-
E. coli (no/100 ml)	0	Pass Guideline	Pass Excellent
Enterococci (no/100 ml)	1	-	Pass Excellent



Water Quality Results Certificate

Sample 4			
	Results	EC Bathing Water Directive (76/160/EEC)	EC Bathing Water Directive (2006/7/EC)
			(For inland waters)
Total coliforms (no/100 ml)	10	Pass Guideline	-
E. coli (no/100 ml)	0	Pass Guideline	Pass Excellent
Enterococci (no/100 ml)	0	-	Pass Excellent

Sample 5			
	Results	EC Bathing Water Directive (76/160/EEC)	EC Bathing Water Directive (2006/7/EC)
			(For inland waters)
Total coliforms (no/100 ml)	1	Pass Guideline	-
E. coli (no/100 ml)	1	Pass Guideline	Pass Excellent
Enterococci (no/100 ml)	0	-	Pass Excellent

Sample 6			
	Results	EC Bathing Water Directive (76/160/EEC)	EC Bathing Water Directive (2006/7/EC)
			(For inland waters)
Total coliforms (no/100 ml)	0	Pass Guideline	-
E. coli (no/100 ml)	0	Pass Guideline	Pass Excellent
Enterococci (no/100 ml)	10	-	Pass Excellent

The testing results in this certificate relate only to the samples described above. Unless otherwise stated, all results are expressed on an as received basis. All analysis was carried out in UKAS accredited laboratory.
Please visit www.swim-safety.co.uk/results-guidance/ for more info on results thresholds.

BACTERIOLOGICAL TEST REPORT



Client: Geotechnical & Environmental Associates
#Address: Woidbury Barn
 Woidbury Hill
 Ware
 SG12 7QE

#Site: Broadwater Lake
#FAO: Alex Goodsell, Katharine Marsland
#Order No: J22242

Job Number: M/1995/101521
Report No.: 122478.1
#Date Tak'n: Mon, 22nd Aug 2022 12:15
Date Rec'd: Tue, 23rd Aug 2022



2266

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 Fax: +44 (0)20 8591 8762
 sales@stanstedlabs.co.uk
 www.stanstedlabs.co.uk

Items Marked ☐ are not included in the UKAS Schedule

Sample ID	#Description & Temperatures	Analysis	Result	Tested	Notes / Species
SL469662 <i>Surface UT - Lake</i>	Location 1	Salmonella ☐ §	ND in 25g	25/08/2022	
	Init Temp ☐ Temp > 1 Min ☐ Temp > 2 Min ☐	Clostridium perfringens ☐	0 cfu/100ml	23/08/2022	
SL469663 <i>Surface UT - Lake</i>	Location 2	Salmonella ☐ §	ND in 25g	25/08/2022	
	Init Temp ☐ Temp > 1 Min ☐ Temp > 2 Min ☐	Clostridium perfringens ☐	0 cfu/100ml	23/08/2022	
SL469664 <i>Surface UT - Lake</i>	Location 3	Salmonella ☐ §	ND in 25g	25/08/2022	
	Init Temp ☐ Temp > 1 Min ☐ Temp > 2 Min ☐	Clostridium perfringens ☐	100 cfu/100ml	23/08/2022	
SL469665 <i>Surface UT - Lake</i>	Location 4	Salmonella ☐ §	ND in 25g	25/08/2022	
	Init Temp ☐ Temp > 1 Min ☐ Temp > 2 Min ☐	Clostridium perfringens ☐	100 cfu/100ml	23/08/2022	
SL469666 <i>Surface UT - Lake</i>	Location 5	Salmonella ☐ §	ND in 25g	25/08/2022	
	Init Temp ☐ Temp > 1 Min ☐ Temp > 2 Min ☐	Clostridium perfringens ☐	200 cfu/100ml	23/08/2022	
SL469667 <i>Surface UT - Lake</i>	Location 6	Salmonella ☐ §	ND in 25g	25/08/2022	
	Init Temp ☐ Temp > 1 Min ☐ Temp > 2 Min ☐	Clostridium perfringens ☐	0 cfu/100ml	23/08/2022	

Method Codes

-
SLM/B316/M - Clostridium perfringens

Legend & Footnotes

cfu = Colony Forming Units
 mpn = Most Probable Number
 TNTC = Too Numerous to Count

§ Subcontracted Test

#Information supplied by the customer and can affect the validity of results.
 Sampling is not included in our UKAS Schedule.
 All Samples Analysed as received.

Test report authorised by :
 Theepa Supikaran

Quality Manager
 Date: 05/09/2022 13:03:45

Test Report checked by : Anusala Tavarasa
 31/08/2022 10:00:38

Disclaimer

Results relate to samples tested and should not be reproduced except in full, without the written approval of the laboratory. Interpretations and opinions are not included in our UKAS schedule.
 00:00 means time not declared.

BACTERIOLOGICAL TEST REPORT



Client: Geotechnical & Environmental Associates

Job Number: M/1995/101521

#Address: Woidbury Barn
Woidbury Hill
Ware
SG12 7QE

Report No.: 122478.1

#Date Tak'n: Mon, 22nd Aug 2022 12:15

Date Rec'd: Tue, 23rd Aug 2022

#Site: Broadwater Lake

#FAO: Alex Goodsell, Katharine Marsland

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----- END OF REPORT -----