

Airport Management Services Limited

SkyCity Golf Course EM&A Monthly Compliance Report



March 2007

Report no: 01332R0161



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Date:

13 April 2007

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1 Executive Summary

The purpose of this Project is to construct and operate a 9-hole Golf Course at the east side of the North Commercial District (NCD) on the Airport Island as an interim arrangement prior to the area's future development as a business park (see Figure 1-1). The proposed interim golf facility, known as "SkyCity Nine Eagles Golf Course" is intended to serve airport passengers, overseas visitors and airport workers until August 2013.

The Project is managed by Airport Management Services Limited (AMS) who have engaged Green Management Ltd to establish and maintain the turfgrass of the Golf Course. Hyder Consulting have been employed as the Environmental Team (ET) for the Construction Period and have engaged ALS Technichem Pty Ltd as the HOKLAS accredited testing laboratory to carry out lake water analysis.

The Construction Period was completed on 31 December 2006. The one month Turfgrass Establishment Period was completed on 31 January 2007. The first phase of the Operation Period, which lasts for three months, commenced on 1 February 2007. According to the approved EM&A Manual, compliance monitoring of lake water quality during the Operation Period is required for suspended solids, dissolved oxygen, BOD₅, nitrogen and phosphorous.

Compliance monitoring was carried out during March 2007 in accordance with the approved EM&A Manual. Monitoring was carried out on 3, 10, 17, 24 and 31 March 2007, at four locations within the two lakes. The monitoring results are detailed in this report, which complies with the reporting requirements stated in the approved EM&A Manual. A lake water monitoring schedule for next two months is provided in Appendix 3.

During the reporting month, there were no exceedance of Action/Limit Levels for lake water quality; there were no complaints received; and there were no notifications of summons. Overall, there were no adverse environmental impacts during the reporting month.

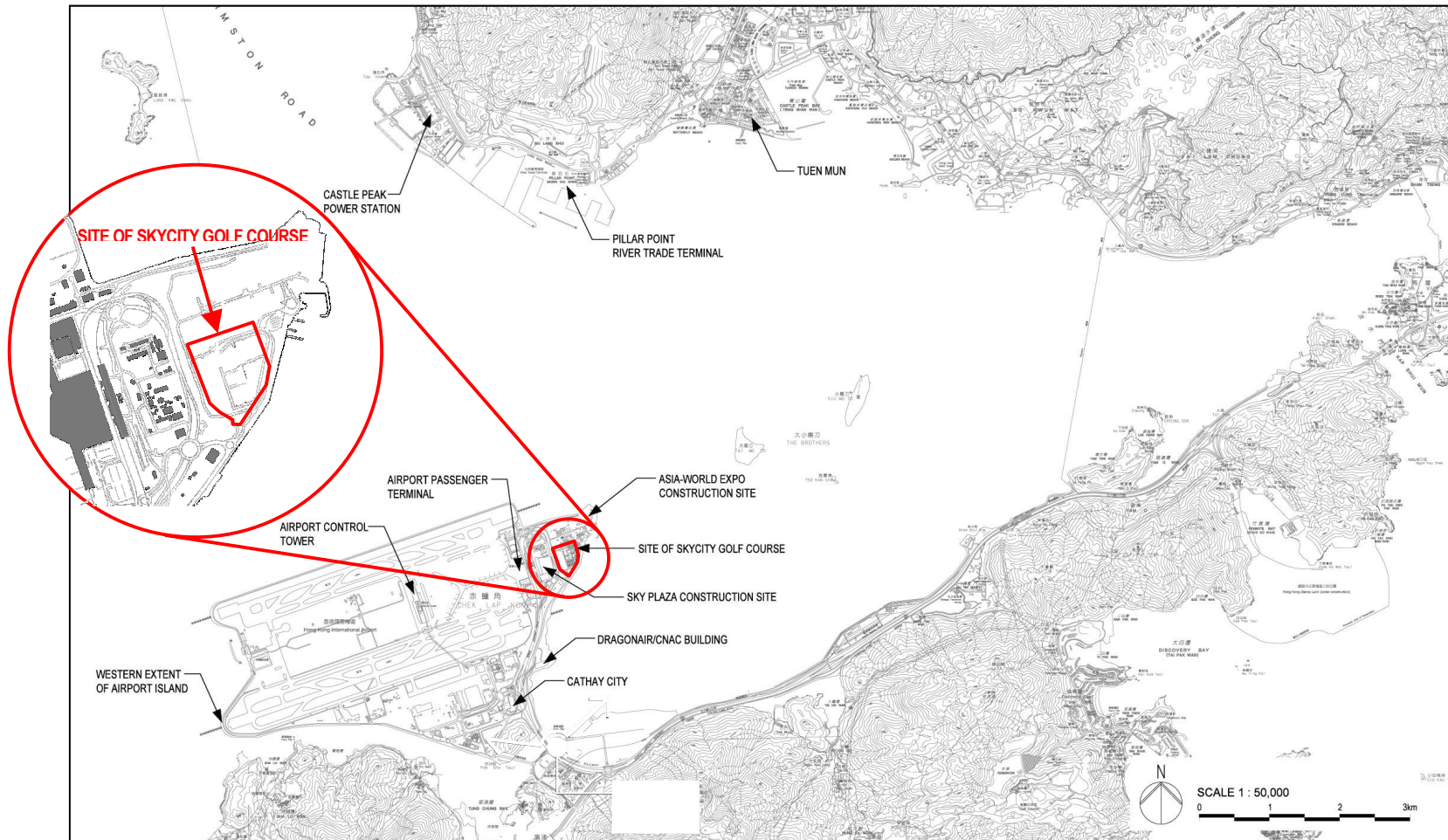


Figure 1-1 Location of SkyCity Golf Course on the Airport Island

2 Lake Water Quality EM&A

2.1 Operational Details

During operation, the Golf Course has been designed to contain water within two artificial lakes. The two lakes are linked together by two underwater pipes, which means that they can be considered as a single water body in terms of water quality and hydrology. Because of the sloping topography of the site, all rainwater collected within the Golf Course will drain into the lakes through a sub-soil drainage system. The lakes provide a source of freshwater for irrigation, from which surplus water will then flow back into the lakes.

The lakes should be maintained at a capacity of 15,000m³. This is not "full" but is the level that provides the required visual appearance. During the winter (dry) months, however, the lakes may fall below this level. The maximum capacity of the lakes is 20,000m³. At the end of the reporting month, the lake depth was 1.5m and the volume was estimated at 15,000m³.

Lake water is sampled on a regular basis to ensure that, should it need to be discharged, it will meet the relevant discharge standards. If more than 20,000m³ of water flows into the lakes, then the Golf Course may flood. To avoid this, the Golf Course Supervisor can authorise the opening of a control valve to allow the water to overflow from the lake and into off-site storm drains that discharge via Outfall No. 8. However, the valve can only be opened if the latest lake water monitoring results indicate that water is of an acceptable quality. In normal circumstances, the control valve remains closed and discharge off-site is not possible. All opening and closing of the control valve will be logged on site.

If the latest lake water monitoring results indicate that water is not of an acceptable quality, then the valve cannot be opened, the lake water cannot overflow and the Golf Course will begin to flood. This is part of the mitigation design to prevent off-site discharge of water that does not meet the required standard. The bund that surrounds the site is at least 1.5m high and up to 90,000m³ of floodwater can be retained within the Golf Course, in addition to the 20,000m³ lake capacity. In this situation, water samples from the flooded Golf Course will be taken more frequently. Only when water has returned to an acceptable quality will the control valve be opened to allow water to overflow from the lake and into off-site storm drains that discharge via Outfall No. 8, thereby allowing the flood to recede.

The system by which this water control is achieved is shown in Figure 2-2.

2.2 Monitoring Results

Monitoring of Dissolved Oxygen (DO) concentration in mg/l, Suspended Solids (SS) in mg/l, BOD₅ in mg/l, Total Nitrogen in mg/l and Total Phosphorous in mg/l was carried out by the ET to ensure that any deterioration in lake water quality could be readily detected and timely action could be taken to rectify the situation if this was due to site operations. DO was measured *in-situ* whilst SS was determined in a HOKLAS-accredited laboratory.

2.2.1 Summary

A summary of lake water monitoring results for the reporting month is provided in Table 2-1, below. Detailed results are provided in Appendix 1, in which exceedances of Action/Limit (A/L) Levels are highlighted.

Monitoring Location		SS (mg/ℓ)	BOD ₅ (mg/ℓ)	DO Saturation (%age)	DO Concentration (mg/ℓ)	Total Nitrogen (mg/ℓ)	Total Phosphorous (mg/ℓ)
W1	Mean	2.4	2.2	93.8	8.6	0.3	0.1
	Minimum	2.0	2.0	90.8	8.3	0.2	0.1
	Maximum	3.0	3.0	100.0	8.9	0.3	0.1
W2	Mean	2.4	2.2	93.6	8.6	0.4	0.1
	Minimum	2.0	2.0	92.0	8.5	0.2	0.1
	Maximum	3.0	3.0	97.3	8.8	1.0	0.1
W3	Mean	2.0	2.0	90.7	8.5	0.8	0.1
	Minimum	2.0	2.0	83.7	8.0	0.3	0.1
	Maximum	2.0	2.0	96.9	8.9	1.0	0.1
W4	Mean	2.0	2.0	93.2	8.6	0.8	0.1
	Minimum	2.0	2.0	88.1	7.9	0.3	0.1
	Maximum	2.0	2.0	97.6	8.9	1.0	0.1

Table 2-1 Summary of Impact Monitoring Data

2.2.2 Equipment and Methodology

Because of the relatively shallow water, *in-situ* measurements and water sampling were conducted at 0.5m from the surface (the mid-point of the 1m deep lake). Water samples for all monitoring parameters were collected, stored, preserved and analysed according to *APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition, #17*.

In-situ DO concentration and DO saturation were carried out using a YSI Model 85 CE-C-M-Y multi-parameter meter and the range, resolution and accuracy of the equipment is provided in Table 2-2:

Parameter	YSI Model 85 CE-C-M-Y		
	Range	Resolution	Accuracy
DO Concentration	0 to 12 mg/ℓ	0.001 mg/ℓ	0 to 20 mg/ℓ: ± 0.2 mg/ℓ of reading
DO Saturation	0 to 150%	0.1%	0 to 100%: ±1% of reading

Table 2-2 *In-situ* Monitoring Equipment Details

A Kahlisco water sampler was used to obtain the water sample for subsequent SS analysis. The volume of the sample shall not be less than 1L and shall be collected in clean high density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to ALS' laboratory (HOKLAS accredited) immediately after completion of monitoring. The determination of the collected samples will start within the next working day after sample collection. The analysis follows APHA *Standard Methods* #2540D.

2.2.3 Maintenance and Calibration

All *in-situ* monitoring instruments are calibrated and certified by ALS at monthly intervals throughout all stages of the lake water quality monitoring programme.

For DO, the probe (YSI 85) is calibrated once per monitoring day by the wet bulb method. Calibration at ALS is carried out once every month in a water sample of known dissolved oxygen concentration. The sensor is immersed in the water and after thermal equilibration, the known mg/l value is keyed in and the calibration is carried out automatically.

Calibration details are provided in Appendix 2.

2.2.4 Parameters Monitored

The following parameters are monitored and compared to A/L Levels:

- Dissolved Oxygen (DO)
- Suspended Solids (SS)
- BOD₅
- Total Nitrogen
- Total Phosphorous

2.2.5 Monitoring Locations

Monitoring locations together with grid references are shown in Figure 2-3. Monitoring Stations are designated as W1, W2, W3 and W4.

2.2.6 Monitoring Date, Time, Frequency and Duration

In accordance with the EM&A Manual, the monitoring frequency of lake water quality is shown as Table 2-3. Monthly monitoring for the first three months of operation has been specified to allow a more rapid accumulation of operational monitoring data and provide greater confidence in the efficacy of the operation of the Golf Course and the EM&A programme itself.

	Turfgrass Establishment and First 3 Months of Operation	
	Below Action/ Limit Level	Action/ Limit Level Exceedance
Monitoring Frequency	Weekly	Bi-weekly

Table 2-3 Monitoring Date, Time, Frequency and Duration

2.3 Action/Limit Levels

According to the approved EM&A manual, the A/L Levels for the compliance monitoring (for monitoring locations W1 to W4) are shown in Table 2-4:

Parameter	Acceptable Standard (mg/ℓ)*	
	Action Level	Limit Level
Suspended Solids	20	30
BOD ₅	13.5	20
Dissolved Oxygen	4	3
Total Nitrogen	20	30
Total Phosphorous	3.5	5

Table 2-4 Action and Limit Levels for Lake Water Quality

In case of exceedance of A/L Levels at monitoring locations W1 to W4, ET shall immediately implement the Event/ Action Contingency Plan as shown in the following Table 2-5 in order to resolve the lake water quality problem:

Event	Action
Exceedance of Action Level	<ol style="list-style-type: none"> 1. Notify the Golf Course Supervisor of the exceedance, providing full details (time, location, parameter, level, etc.). 2. Increase the frequency of monitoring of the particular parameter(s) to "Action/Limit Level Exceedance" as shown in Table 2-4. 3. If water quality continues to worsen, it may be prudent to review the Turfgrass Management Plan (TMP) in terms of application of nutrients and agree any revisions with the Golf Facility Supervisor. 4. Notify the Golf Facility Supervisor when water quality falls below "Action Level" and reduce monitoring frequency to "Below Action/Limit Level" as shown in Table 2-4.
Exceedance of Limit Level	<ol style="list-style-type: none"> 1. Notify EPD and Golf Course Supervisor of the exceedance, providing full details (time, location, parameter, level, etc.). 2. Suspend any ongoing application of organic nutrients. 3. Determine the likely cause of the exceedance(s). Review the TMP in terms of application of nutrients and agree any revisions with the Golf Facility Supervisor. Continue to irrigate the Golf Course using lake water. 4. Increase the frequency of monitoring of the particular parameter(s) to "Action/Limit Level Exceedance" as shown in Table 2-4 (if not already at this frequency) to demonstrate the effectiveness of remedial measures and to confirm that water quality has returned to acceptable levels. 5. Notify EPD and Golf Course Supervisor when water quality falls below "Action Level" (not "Limit Level") and reduce monitoring frequency to "Below Action/Limit Level" as shown in Table 2-4.

Table 2-5 Event Action Plan for Lake Water Quality Monitoring

2.4 Summary of Exceedances

2.4.1 Review of Exceedances and Implications

There was no exceedance of Action/Limit Level of lake water quality monitoring during March 2007.

2.4.2 Action Taken and Follow-up

As no exceedance of A/L Levels were recorded during the reporting month, no action or follow-up is deemed to be necessary.

2.5 Complaints and Notifications of Summons

2.5.1 Complaints

No complaints were received during the reporting month and there are no outstanding follow-up issues to be addressed.

2.5.2 Notifications of Summons

No notifications of summons were received during the reporting month and there are no outstanding follow-up issues to be addressed.

2.6 Future Monitoring Schedule

From 1 February 2007 to 30 April 2007, the first three months of operation, the EM&A schedule will comprise weekly monitoring and monthly reporting. Thereafter, monitoring will be carried out monthly and will be reported quarterly. Should any exceedance of A/L Levels occur, monitoring frequency will be increased as specified in the EM&A Manual – this will not be reflected in the monitoring schedule.

The lake water monitoring schedule for the next month is provided in Appendix 3.

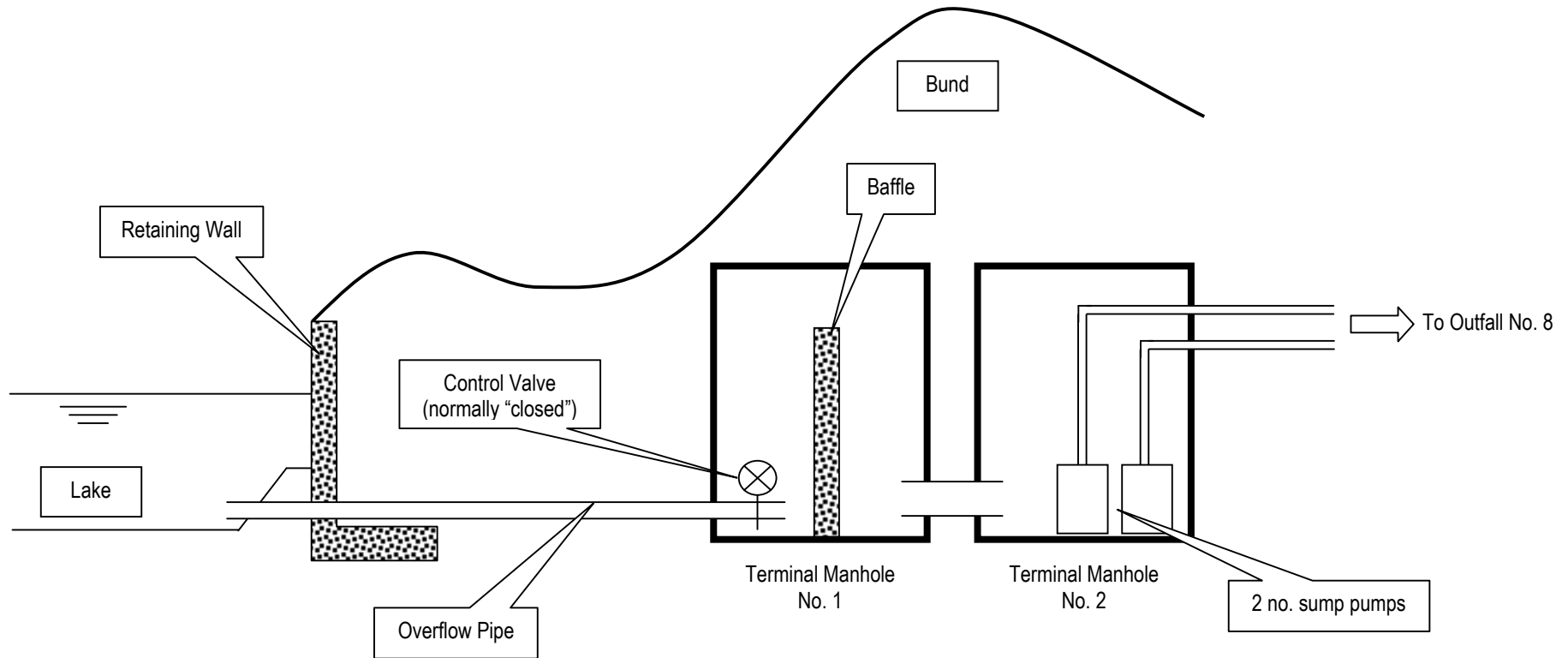


Figure 2-2 Schematic of Lake Water Control System

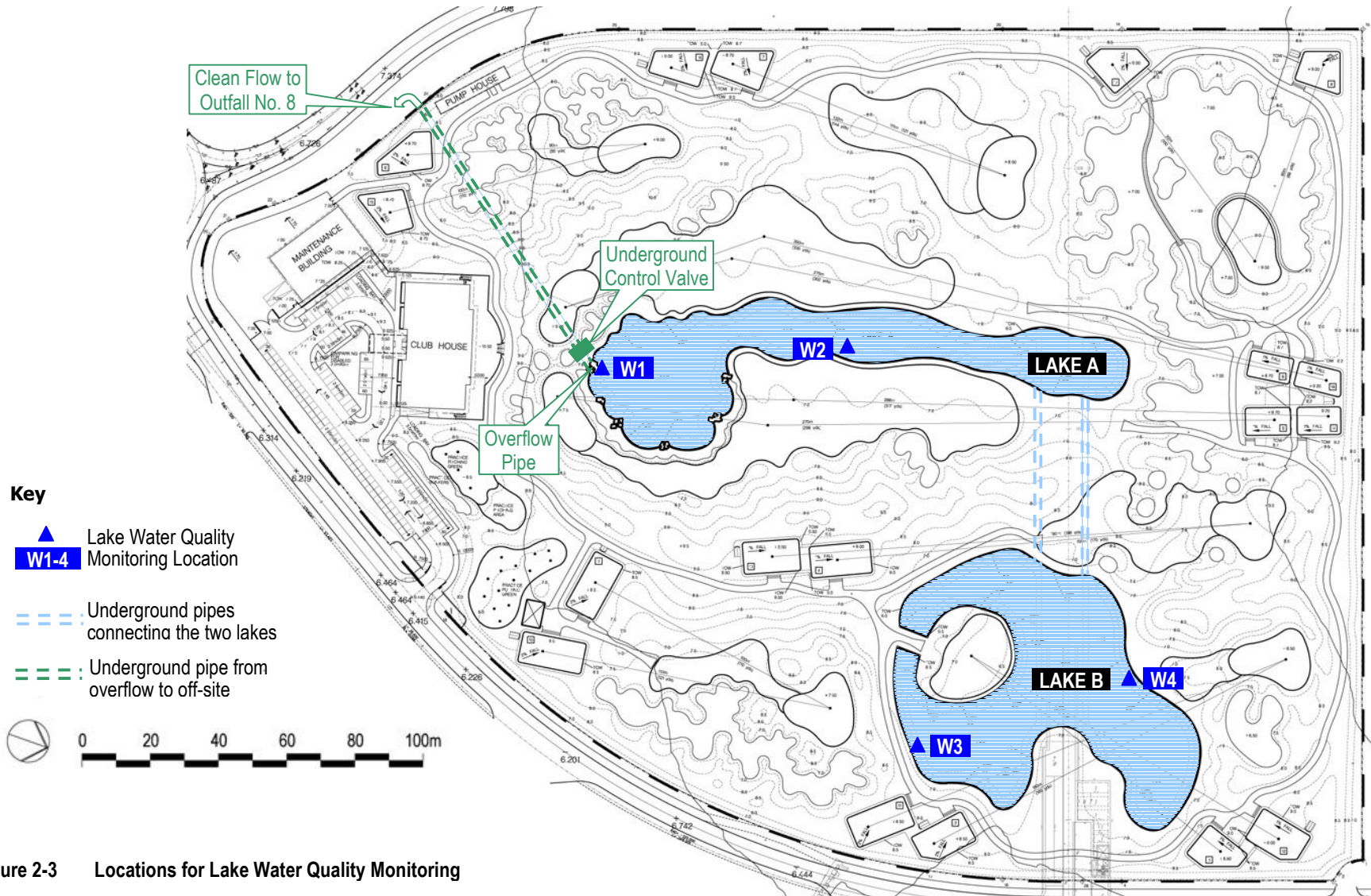


Figure 2-3 Locations for Lake Water Quality Monitoring

3 Comments, Recommendations and Conclusions

Compliance monitoring was carried out during March 2007 in accordance with the approved EM&A Manual.

Monitoring was carried out on 3, 10, 17, 24 and 31 March 2007, at four locations within the two lakes.

During the reporting month, there were no exceedance of A/L Levels for lake water quality; there were no complaints received; and there were no notifications of summons.

Overall, there were no adverse environmental impacts during the reporting month.

Appendix 1

Lake Water Quality Monitoring Data

Date	Time	Station	SS (mg/ℓ)	BOD ₅ (mg/ℓ)	DO Saturation (%)	DO Concentration (mg/ℓ)	Total Nitrogen (mg/ℓ)	Total Phosphorous (mg/ℓ)
3-Mar-07	8:30	W1	2.0	2.0	90.8	8.3	0.3	0.1
	8:40	W2	2.0	2.0	92.0	8.5	1.0	0.1
	8:50	W3	2.0	2.0	83.7	8.6	1.0	0.1
	9:00	W4	2.0	2.0	95.1	8.7	1.0	0.1
10-Mar-07	8:40	W1	3.0	2.0	92.0	8.7	0.2	0.1
	8:50	W2	2.0	3.0	93.1	8.7	0.2	0.1
	9:00	W3	2.0	2.0	96.9	8.9	0.8	0.1
	9:10	W4	2.0	2.0	97.6	8.9	0.8	0.1
17-Mar-07	8:30	W1	2.0	2.0	100.0	8.6	0.3	0.1
	8:40	W2	3.0	2.0	97.3	8.5	0.2	0.1
	8:50	W3	2.0	2.0	93.6	8.0	0.3	0.1
	9:00	W4	2.0	2.0	92.9	7.9	0.3	0.1
24-Mar-07	10:30	W1	3.0	3.0	93.1	8.9	0.3	0.1
	10:40	W2	3.0	2.0	92.9	8.8	0.4	0.1
	10:50	W3	2.0	2.0	89.7	8.7	0.9	0.1
	11:00	W4	2.0	2.0	92.2	8.9	0.9	0.1

Date	Time	Station	SS (mg/ℓ)	BOD ₅ (mg/ℓ)	DO Saturation (%)	DO Concentration (mg/ℓ)	Total Nitrogen (mg/ℓ)	Total Phosphorous (mg/ℓ)
31-Mar-07	8:25	W1	2.0	2.0	93.1	8.6	0.2	0.1
	8:35	W2	2.0	2.0	92.9	8.6	0.3	0.1
	8:45	W3	2.0	2.0	89.7	8.4	1.0	0.1
	8:55	W4	2.0	2.0	88.1	8.4	1.0	0.1
Mean			2.2	2.1	92.8	8.6	0.6	0.1
Min			2.0	2.0	83.7	7.9	0.2	0.1
Max			3.0	3.0	100.0	8.9	1.0	0.1

Note : “-“ indicates no data is available

Bold indicates Action Level exceedance

Bold indicates Limit Level exceedance

Appendix 2

Equipment Calibration Details

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS TECHNICHEM (HK) Pty Ltd

Environmental Division



CERTIFICATE OF ANALYSIS

CONTACT:	MS WINNIE MA	Batch:	HK0704473
CLIENT:	HYDER CONSULTING LTD	Sub Batch:	0
ADDRESS:	47/F, HOPEWELL CENTRE, 183 QUEEN'S ROAD EAST, WANCHAI, HONG KONG	LABORATORY:	HONG KONG
ORDER No.:		DATE RECEIVED:	21/03/2007
PROJECT:		DATE OF ISSUE:	03/04/2007
		SAMPLE TYPE:	EQUIPMENT
		No. of SAMPLES:	1

COMMENTS

The calibration procedure used for the analysis has been applied for the calibration of the above instrument.

NOTES

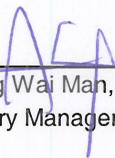
This is the Final Report and supersedes any preliminary report with this batch number.
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

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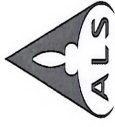
AUSTRALIA		AMERICAS
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Abbreviations: % SPK REC denotes percentage spike recovery
CHK denotes duplicate check sample
LOR denotes limit of reporting
LCS % REC denotes Laboratory Control Sample percentage recovery

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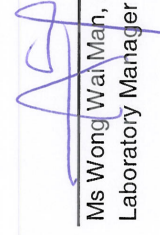
Batch: HK0704473
Sub Batch : 0
Date of Issue: 03/04/2007
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of DO System

Item : YSI Multimeter
Model No. : YSI 85/10FT
Serial No. : 01J0362AJ
Equipment No. : HK065
Calibration Method : This meter was calibrated in accordance with standard method APHA (18th Ed.) 4500-OC & G
Date of Calibration : 22 March, 2007

Testing Results :

Expected Reading	Recording Reading
0.00 mg/L	0.05 mg/L
1.10 mg/L	1.08 mg/L
5.25 mg/L	5.11 mg/L
8.29 mg/L	8.36 mg/L
Allowing Deviation	±0.2 mg/L


 Ms Wong Wai Man, Alice
 Laboratory Manager - Hong Kong

Appendix 3

Lake Water Monitoring Schedule for Next Month

Month: April 2007		
Sampling Date	Matrix	Sampling Locations
07-Apr-07	Lake Water	W1 to W4
13-Apr-07	Lake Water	W1 to W4
20-Apr-07	Lake Water	W1 to W4
27-Apr-07	Lake Water	W1 to W4